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SMOKE IN MANHATTAN.

Owing to the strike in the anthracite coal field, Greater New York has taken on the atmospheric aspect of Western and European cities, where soft coal is consumed. The complaints are numerous and loud, for one of the charms of New York has always been the absence of the smoke and dirt due to the use of bituminous coal. Particular complaint is laid against the small locomotives of the Elevated Roads, which distribute their fumes impartially from one end of the city to the other. There seems little relief from the situation until the anthracite strike is over, but the lesson has already been taught that electric traction should long ago have been adopted for the elevated system. The contrast between the Second Avenue line, with electricity, and the others with steam, is most striking. The point is also brought out that electricity is a great agency for centralizing power production and for putting the consumption of fuel at places where it can cause least annoyance to a community. Light and power plants to-day go to the outskirts of communities, and the use of fuel in the other localities thus steadily becomes minimized.

THE INSTITUTE MEETING.

Full details were printed in our pages last week with regard to the meeting of the American Institute of Electrical Engineers at Great Barrington next week. It will have been seen that the business programme is strong in features of great interest and importance, while the social features are of great variety. Electricity and electrical engineers have always had a firm hold upon the affections of the residents of the beautiful Berkshire Hills, to which the science and art owe some of their best American representatives, and we do not believe that any body of men could be welcomed with greater enthusiasm than the members of the Institute. In fact, the overflowing programme of hospitality looks almost as though our good Berkshire friends had let their cordiality of welcome run away with them. The guests, to say nothing of the hosts, will certainly be tired when the week is over, if any conscientious attempt is made to participate in every function of business and sociability that the programme provides. We understand that the attendance will be good, and we trust that the members and their friends will turn out in force. It will be in every respect a profitable week, as our details this week show.

INDEPENDENT TELEPHONY.

Now that announcement has been made of the independent telephone convention to be held at Philadelphia in the last week of this month, it will be seen to what extent interest continues in that annual affair, for we can hardly believe that the recent local or interstate meeting at Chicago has had any serious effect in deterring from attendance those who would go. At any rate, we hope such is not the case. If independent telephony is to be a real force in the country—and a large opportunity exists for it in many ways—its practical exponents must get together. We know of no progressive art in which the practitioners do not from time to time get together, and in such an industry as the telephonic it is peculiarly desirable. The independents are scattered, are often without accumulated experience, are not well acquainted with each other, and greatly need the interchange of ideas and sympathies. The recent electric light convention at Cincinnati showed how even after nearly 20 years, there remains work for the National Electric Light Association to do; and curiously enough in the early days that body was regarded by the Edison Companies very much as the Bell Companies now regard the independents—intruders and outsiders not to be associated

with. But we think we can imagine a time in the near future when, having justified itself by good work, the Independent Telephone Association can become a powerful influence for the technical advance of telephony, and when Bell telephone men will readily and gladly belong to it, not because it is "independent," but because it is the national organization of operating telephone companies. This may not happen, but if it did it would not be without precedent. What is necessary, however, above all things, is that not the telephone manufacturers alone, nor the supply men, should get together in convention, but that the managers of the local companies should all turn out and benefit by conference.

Magnetization of Steel at the Temperature of Liquid Air.

A paper by Mr. C. C. Trowbridge recently published by the American Physical Society, on certain brands of carbon steel and tungsten steel, magnetized at the temperature of liquid air (—185° C.) contains results of some practical interest. It seems that the intensity of magnetization induced in these magnets was practically the same as at normal temperatures; also that the warming of the magnets from —185° C to +20° C after initial magnetization in liquid air, caused them to lose an appreciable fraction, 11 to 38 per cent., of their magnetic intensity. It seems, therefore, that no advantage is to be gained by magnetizing hard steel bars at very low temperatures.

Decorative Lighting.

Two of the Electric Light Convention papers are of particular interest as dealing with the temporary and permanent use of incandescent lamps for illuminated signs and for miscellaneous decoration. It is a branch of electrical industry of comparatively recent growth but of very striking developments. To one who can carry a mental picture of the New York of ten years ago, the change in the city's aspect by night is little short of startling. Go across either river in the evening and the eye falls on almost a wall of incandescent signs, proclaiming the transcendent virtues of everything from a transportation line to a new brand of whisky. And within even the last year or two the change has been prodigious. It is hard to place one's finger on any one actuating cause, for there have been several at work. The introduction of good and durable lamps of moderate candle power has been one important factor in the growth of decorative lighting, and another perhaps has been the broad policy inaugurated by the great central stations, which has made it worth while to go into electric lighting on a larger scale than would before have been economically possible. At all events the work has been done and the result is striking, not to say lurid. Several well-defined systems for the convenient connection of incandescent lamps into even very complex decorative forms have been worked out, and they have not only made permanent installations comparatively cheap and easy, but have rendered possible temporary work on a scale that would have been a sheer impossibility even a few years ago. As a case in point, the decorations carried out at the Metropolitan Opera House for the performance in honor of Prince Henry of Prussia would have been virtually impossible save for the improved methods called into service. The public is coming fully to realize that incandescent advertising is tremendously effective, and unless we miss our guess, it will be a branch of that noble art which will have a great future. But providentially, electric lighting does not lend itself readily to elaborate pictorial representations, which robs the possibilities of patent medicine advertising of some of their horrors. Purely decorative work is as much influenced by the improvements in methods as is advertising, so that with the garish and grotesque we may get the artistic and beautiful. The growth in both classes of work will have, and is having, no inconsiderable bearing on the output of central stations and upon their future prospects.

The Possibilites for a Light-Weight Storage Battery.

The article on this subject in our last number by Prof. A. L. Marsh, is suggestive as to the direction in which automobile storage batteries may be improved. There is not only room for improvement, but also weight for improvement, to be considered in these batteries. For central station purposes, the lead battery is satisfactory, although far from perfect. Its depreciation under standard conditions of service is heavy by comparison with the better class of solid machinery, but it is at least definite and capable of being reliably computed. In spite of its depreciation, the lead storage battery is of great importance to central station direct-current distribution, and it could not be dispensed with. In vehicles, however, the lead is a heavy drawback. Theoretically, as Prof. Marsh shows, lead-peroxide can yield over 100 ampere-hours per pound. But not only are the conditions of discharge such that only about one-third of the theoretical electric quantity can be realized, but in order to employ lead-peroxide, a relatively large amount of solid lead has also to be carried, in order to support the peroxide. If lead were not such a heavy metal, and, moreover. if it were not structurally so weak a metal, the supporting grid would not be a severe handicap to the automobile battery. As it is, however, instead of obtaining 80 watt-hours per pound of battery, which would be the approximate theoretical limit for a lead battery, we can only obtain about 12 to 14 watts per pound for a vehicle-battery, with relatively heavy depreciation, and 6 to 7 watt-hours per pound for a stationary battery, where weight is of lesser consequence as compared with duration of life.

Whatever may be hoped for the future, the lead storage battery, heavy as it is, is the only one which has stood the test of time, and which is used commercially in automobiles. But the weight and depreciation of the battery are such as to restrict the range and capability of electric automobiles within comparatively narrow limits. According to the article, the oxidation of iron as the negative material, together with the reduction of peroxide of nickel to the oxide, as positive material, gives the best available ampere-hour capacity per pound of matter. These are the substances in the Edison cell, although it is a moot point as to whether, in that cell, the nickel-peroxide is reduced to the sesqui-oxide, or to the oxide. But if the Edison storage battery comes into successful practical use, it will probably owe its superiority to the mechanical strength of its steel grids and to the small quantity of solution it requires, as much as to its ampere-hour capacity. The competition is not so much that of a 1.1-volt cell of large ampere-hour capacity against a 2-volt cell of lesser ampere-hour capacity, as the competition of two types of cell as regards reliability and absence of depreciation. But even if we obtain 20 watt-hours per pound of battery, this only means the inherent theoretical potentiality of lifting its own weight ten miles against sea-level gravitation as against a lifting potential energy of three thousand miles in petroleum; although the petroleum motor secures but a small percentage of this enormous potential energy. In convenience, simplicity and cleanliness, however, the electric automobile will always excel the petroleum automobile.

Grounding Secondary Circuits.

Elsewhere we print the replies from central station men to a N. E. L. A. query asking if it is desirable to ground transformer secondaries as permitted by a specified rule of the National Underwriters' code. Though none the less interesting, this discussion is somewhat belated, for the subject was most thoroughly threshed out during a period of several years previous to the adoption of the rule mentioned; moreover, the rule secured adoption only after strong and long-continued pressure had been exerted on reluctant underwriters by electrical interests. The discussion at Cincinnati manifested a considerable difference of opinion. The minority

seemed to be opposed to grounding secondary distribution circuits, either for the reason that grounded overhead wires on poles may invite more danger from high-tension crosses; or, for the reason that a ground for a secondary system cannot be made sufficiently good to protect from a high-tension cross, while inviting trouble in the transformers from lightning. The majority of answers are in favor of grounding secondaries, but some are in doubt as to the best method to employ. The arguments on both sides of this question are well known, and have undergone no appreciable change in the light of the most recent practice. It needs no argument to carry the conviction that if primary and secondary distribution circuits could always be kept entirely separate, it would be better to keep the secondary consumption circuits insulated. But, as a matter of fact, transformers are subject to accidental break-downs like all other apparatus, and the liability to fire hazard and to personal danger are lessened if, when the secondary and primary systems are crossed, the secondary circuit is grounded. Moreover, in some secondary systems there are dangers due to electrostatic inductive effect from the primary high-tension system through the transformers, even when the insulation between the circuits is normal. It s generally admitted that if a secondary consumption circuit is effectively grounded, the secondary system will be free from all danger to the consumers should a cross between primary and secondary circuits accidentally occur. The tendency of the cross would naturally be to blow one or both of the primary fuses of the transformer, and thus to call attention to the defect.

The residual question is whether the grounding of the secondary circuits is likely to be a serious drawback to operation by bringing about more frequent break-downs in transformers, due to lightning. Experience has not indicated serious troubles arising from this source. The benefits to be derived from grounding secondaries appear far to outweigh the disadvantages of the practice. Considering the possibilities for fatal accidents that attach to an accidental cross between primary and secondary circuits in or near the transformer, whereby a consumer, turning on an incandescent lamp while standing on a well grounded metal flooring may bring the primary pressure upon his body, it is wonderful how few accidents of this kind do actually occur, and at the same time the fact is a tribute to the manufacturers of the transformers in general use. Some day, perhaps, a prominent citizen may be accidentally hurt in this manner, and the result is likely to be a demand for the general grounding of secondary systems. The principal difficulty in connection with the practice of grounding secondaries, is in establishing a reliable ground. In some localities a hard rock subsoil may practically render local grounding impossible. In most places, however, a good ground can be obtained inexpensively, either by driving an iron pipe or a pointed iron rod vertically into the ground to the level of permanent moisture; or, by burying a copper plate in a mass of coke below the base of the nearest pole carrying the overhead wires.

WIRELESS TELEGRAPHY.

Lieut. Beecher's paper on the naval experiments on wireless telegraphy, read at the recent special meeting of the Institute, is most satisfactory evidence of the progress that is being made on this side of the water. It is the more important from the absence of the "gags for the gallery" that are all too common in the literature of the subject. We are inclined to believe that the work of the Navy and the Signal Corps in this direction is as thorough and fruitful of results as that done by commercial experimenters at large, and we value it the more highly because the officers in charge make no claim of signals reflected from the moon, or direct messages from Manila, or of a universal multiplexing system. Marconi and others have certainly accomplished results of startling significance, but we have nevertheless a grim suspicion that if the whole body of reports published could be put through a sieve which would separate fact from fancy, and things done from things hoped for, we could find use for a larger wastebasket than now adorns our sanctum. In short, we are disposed to believe that there is here, as always, a certain element of bluff in the claims of some rival inventors, which will gradually be eliminated as the details of the art becomes more familiar. Hence a comparatively unbiased study of the subject, with no stockholders to be filled with enthusiasm, has a definite value as mental ballast. Lieut. Beecher's direct confirmation of the generally believed facts regarding the large relative difficulty of sending overland is especially important as bearing on the possibile military uses of the art. It is pretty well understood that the wireless equipments sent to South Africa were comparatively unproductive of useful results, and it may turn out that such an experience was to have been anticipated. The amounts of energy hitherto used in wireless sending have been comparatively small, and it may be that for use on land and for long-distance work at sea, energy must be much more liberally supplied. We understand that the Japanese government has recently ordered, in this country, some coils of extraordinary power, and is preparing to attack the problem on a large scale. In distributing non-directed energy from a point, there should be provision for a large supply if the signals are to be effective over long distances, and here, perhaps, has been a common source of unsatisfactory achievement. At present there is so much secrecy in the whole subject that it is hard to arrive at a more definite conclusion than that the art has a great future.

We have no desire to discourage the real workers in the field, whose feats we are watching with the utmost interest, but on the other hand we are not disposed to toss bouquets at every promoter who can fill a sensation-seeking reporter with alleged great discoveries. We are tired of seeing dispatches from Biertheman Tank relating how Dr. von Katzenjammer and Lieut. Baron von Wurstenkrieg have devised a system quite distinct from those of Marconi and Slaby, which will (please note the tense) permit the reception of 17 messages from different points simultaneously on the same instrument; or have introduced a pocket apparatus with a range of 200 kilometers, which has already been ordered for general distribution to the 41,144th Battalion of Manchurian Sappers. In wireless telegraphy one is dealing with a most interesting and important branch of physical science, which is as yet very imperfectly reduced to general principles, and which needs careful, thorough, scientific work of a very high order. It is at present passing through a stage of development strongly reminiscent of the early stages of telephony, when there was much fumbling in the dark for results, and the most extravagant claims were made for alleged improvements which have long since dropped out of sight. There was a day of "systems," too, in the early years of electric lighting, from which the art emerged only after long and patient work on the part of many experimenters. We are particularly glad that the subject is being so seriously taken up by the military and naval services under the guidance of accomplished experimenters, and we trust that the Government will be most liberal in providing for the support of the work. For military science is every day more dependent on general science. A battleship of these days comes nearer to being a floating machine shop than a ship, and an army is in every stage of its equipment drawing upon all of the resources of applied science. The scientific branches of the service ought to have, therefore, all the aid and encouragement that Congress can afford them. It is of vastly greater national importance that army and navy should be at the highest point of efficiency than that Sculpin Creek should be dredged to admit deep sea commerce, even though the former work gives no job to superfluous heelers.

Meeting of the New York Electrical Society.

SOCIETY'S BADGE.

The 225th meeting of the New York Electrical Society was held June 4th. Dr. William Hallock lectured on "The Magnetic Deflection of Steel Plumb Lines in Deep Mines." The subject has already been noted in ELECTRICAL WORLD AND ENGINEER. In the course of his lecture, Dr. Hallock said that in the search for copper in the ever-increasing quantities needed for the electrical industries, the Tamarack Mining Company has sunk the deepest shaft in the world in order to tap the vein which slopes downard from the surface. This hole is ell over a mile in depth. In order to connect a point on this shaft with the older workings of the mine, it became necessary to "plumb down" two points so as to be able to start in the right direction to meet the other tunnels. This operation was undertaken at the 29th level, with lines 4,250 feet long, with steel piano wire, No. 24, carrying a fifty-pound iron weight. The two plumb-lines were about 17 feet apart, and it was found on accurate measurement that in one case they were 0.11 feet and in another 0.07 feet farther apart at the bottom than at the top. It was supposed that possibly they might be closer together on account of the convergence of the earth's radii, or the attraction of gravitation between the two weights. Various suggestions were offered for the divergence, air currents, attraction of the walls, etc. Owing to the fact that the weights were in an enclosed space they would not be under any force of attraction due to the surrounding walls, and if the walls did attract it would be quantitatively too small, only about one-hundredth of that observed.

The well-known observations upon the very strong magnetization of the steel casing used in gas and oil wells suggested that the wires were magnetized by the vertical component of the earth's field, and having two north poles at the bottom would repel each other. A series of experiments made in the 100-ft. shaft of the Physical Laboratory, at Columbia University, with plumb lines 75 feet long, showed conclusively that they are repelled from each other and that the bottom is drawn toward the north. The measured displacement was about 0.3 mm., or 0.012 in., which was very easily measured with a microscope. It was found that owing to the lack of homogeneity of the wires irregularities of magnetization were developed, which tended to increase the repulsion.

Prof. F. W. McNair and Chief Engineer Watson, of the mine, have since made a considerable series of experiments with bronze wires and lead weights, which gave results very similar to those originally obtained. This goes to show that a study of the air circulation was necessary, and they concluded that the disturbances were due to air currents. Of course it may be that the deflections were mainly due to air currents, but the observations at Columbia would show that magnetic deflections are to be expected, and, indeed, may have been present with the other in some cases. In Dr. Hallock's opinion the moral of the whole experience should be: use bronze wires and lead weights and do not use such long lines, unless air circulation can be completely stopped.

After the conclusion of Dr. Hallock's lecture the society adjourned to the office of the American Telegraphone Company. The members were received by Mr. E. W. Creecy, the vice-president of the company, who gave an address on the commercial side of the telegraphone. The subject was covered technically by Mr. Wm. J. Hammer. The capabilities of the instrument were practically demonstrated.

The following nomination for officers for the ensuing year has been made by the Nominating Committee: For president, Dr. Samuel Sheldon; for vice-presidents, Henry A. Lardner, George Herbert Condict, H. V. A. Parsell (for re-election), W. I. Donshea, Hobart D. Betts and W. S. Barstow; for secretary, George H. Guy (for re-election); for treasurer, Henry A. Sinclair (for re-election). The annual meeting and dinner is fixed for June 12.

The new badge of the society is now ready for distribution. The comment has often been made that the badges of the leading societies were all very much alike, and that while the members themselves might be familiar with them, the public frequently failed to recognize any material difference between them. The new badge of the society may be welcomed as being one of the most distinctive and original that has been adopted by a technical body in many years, not only having a character of its own, but embodying symbolically the underlying ideas that are broadly connected with the electrical art and industry. The design of the badge is a modified circular medallion five-eighth inch in diameter, representing a compass, the modifications consisting of four semi-circular extensions on the rim equi-distant, and containing the letters N Y E S, of blue enamel, these standing for the four cardinal points. The rim is a gold band 3-32 in. wide on face, and ornamented with engraved scrolls; the center a field of blue enamel containing a vertical compass needle of gold.

The Institute Meeting in the Berkshires.

We devoted a page last week to the Institute programme for the meeting at Great Barrington, on June 18, 19, 20 and 21, and now briefly recapitulate the distribution of the same:

WEDNESDAY, JUNE 18TH.

Nine o'clock. Papers and Discussion upon Alternating Current work as follows: 3.—"Method of Compounding Alternating Current Generators and Motors, Direct-Current Generators, Synchronous Motor Generators and Synchronous Converters," by Mr. F. G. Baum, of Stanford University, Calif. 6.—"Formula for Calculating the E. M. F. at Any Given Point on an Alternating Current Transmission Line," by Mr. Maurice Le Blanc, of Paris, France. 8.—"The Predetermination of Alternating Characteristics," by Prof. L. A. Herdt, of Montreal. 4.—"The New Generating Plants of the Niagara Falls Power Company," by Mr. Harold W. Buck, of Niagara Falls, N. Y. 15.—"Notes on an Experiment with Single-Phase Alternators on Polyphase Circuits," by Mr. C. O. Mailloux, of New York. 5.—"Notes on the Theory of Synchronous Motors, with Special Reference to Surging," by Pres. Charles P. Steinmetz, of Schenectady, N. Y.

THURSDAY, JUNE 19TH.

Nine o'clock. Papers and Discussion upon Electric Railway work as follows: 12.—"A Study of the Heating of Railway Motors," by Mr. A. H. Armstrong, of Schenectary, N. Y. 10.—"Method of Ascertaining from Dynamometer Car Records the Power Required to Operate the Mott Haven Division of the N. Y. C. & H. R. R. R., and the Relative Cost of Operation by Steam and Electricity," by Mr. B. J. Arnold, of Chicago. 16.—"Comparative Acceleration Tests of Steam and Electric Traction," by Messrs. B. J. Arnold, of Chicago, and W. B. Potter, of Schenectady. 9.—"Notes on Railway Speed-Time Curves," by Mr. C. O. Mailloux, of New York.

FRIDAY, JUNE 20TH.

Nine o'clock. Papers and Discussions upon General Topics as follows: 1.—"The Function of Series and Shunt Resistances in Lightning Arresters," by Mr. Percy H. Thomas, of Pittsburg, Pa. 2.—"A New Photometer for Incandescent Light and Similar Sources," by Prof. C. P. Matthews, of Lafayette, Ind. 7.—"A New Type of Current Tracing Instrument," by Prof. R. B. Owens, of Montreal. 18.—"Energy Loss in Commercial Insulating Materials when Subjected to High Potential Stress," by Mr. C. E. Skinner, of Pittsburg. 19.—"The Electrostatic Wattmeter in Commercial Measurements," by Mr. Miles Walker, of Pittsburg.

SATURDAY, JUNE 21ST.

Closing session, 9 A. M. Papers and Discussion upon the Education of an Electrical Engineer: "Opening Address upon the General Subject," by President Steinmetz. 13.—"The Present Status of Electrical Engineering Education in the United States," by Dr. Samuel Sheldon, of the Polytechnic Institute of Brooklyn, N. Y. 14.—"The Electrical Engineering Courses at College," by Mr. E. B. Raymond, of Schenectady, N. Y. 17.—"The Equipment of an Electrical Engineering Laboratory," by Prof. R. B. Owens, of McGill University, Montreal. 11.—"Electrical Engineering Courses at College," by Prof. Wm. Esty, Lehigh University, Bethlehem, Pa. "An Engineer's Views on Electrical Education," by Mr. Harold W. Buck, of Niagara Falls, N. Y.

A special train leaves New York, from the Grand Central depot, at 2 P. M., on Tuesday, June 17, arriving at Great Barrington about 5:30 P. M.

The Pacific Cable Bill.

The Pacific Cable Bill has been killed for this session in the House of Representatives by a vote of 116 to 77.

The Braun and Siemens and Halske Wireless Telegraph System.

BY A. FREDERICK COLLINS.

THE wireless telegraph suit instituted by Siemens and Halske against the Allgemeine Elektricitäts-Gesellschaft, of Berlin, has called forth considerable comment and aroused great interest, not only in Germany but in England as well, especially since reports have been received that the Braun contentions have been sustained. The systems are those invented by Prof. F. Braun, of Strassburg, who has joined the Siemens and Halske forces, and Dr. A. Slaby, of Charlottenburg, and Count Arco, who have disposed of their interests to the Allgemeine Elektricitäts-Gesellschaft.

I have just received from Dr. Braun an authentic description of the apparatus he has invented and the text of his theory of syntonic wireless telegraphy. One of the most striking features of the Braun and Siemens and Halske system, as it is now known, is the absence of all earthed connections, and this original departure from the beaten paths of commercial wireless telegraphy places it at once in a class by itself.

Another clever arrangement takes advantage of the persistent oscillations of the closed circuit and the radiating qualities of the open-circuit oscillator. By a similar construction of the receiver, the transmitter sends out waves of a certain definite length only, and waves of this length only may be received. This harmonization between the two sets of instruments is so carefully planned that the system requires no earthed connection, although that has been found so necessary in all others heretofore invented. Since the earth is charged to the opposite sign to the electrified upper strata of air, it is really the cause of atmospheric disturbances in wireless telegraph apparatus. The supposition that a system in which the earthed connections are eliminated would be free from such untoward influences has found abundant justification in experiment and practice in Dr. Braun's invention.

The difficulties met with in a practical syntonic wireless telegraph system are due chiefly to the enormous capacity loaded upon the oscillator by the grounded arm; this, and the fact that free, *i.e.*, undamped oscillations are required to effect resonance in a properly tuned receiver, have been the stumbling block of inventors who essayed this rôle. Lodge has shown that the closed circuit is a persistent oscillator[1] and a feeble emitter, and that in the open circuit oscillator the damping coefficient is large and its radiating properties are correspondingly great. Fleming has pointed out how these high-frequency, high-potential oscillations may be transformed,[2] just as the ordinary commercial alternating current is stepped-up or stepped-down. Braun has found it convenient to do away with the earthed terminals of the oscillating system, and discovered a method to utilize the persistent oscillations of the closed circuit and then transforming them in a second oscillator of the open-circuit type.

Before describing Dr. Braun's invention, it may be well to explain, in a limited way, the general points. The arrangement combining the open and closed oscillators to produce the maximum number of oscillations per charge and the greatest amount of energy radiated per oscillation is shown in Fig. 1, in which S is the spark-gap, C C condensers of the Leyden-jar type, and L an inductance coil. This constitutes the closed oscillating system. The inductance coil L forms the primary of the transformer, having for its secondary the coil M, by which the periodicity of the high-frequency, high-potential current is stepped-up or down according to the length of electric wave it is desired to operate with. One of the terminals of the secondary coil, M, is attached to the vertical wire, or antenna A, which should be equal to one-fourth the wave length emitted by the oscillations set up in M. The opposite terminal of the secondary coil, M, may be rolled up loosely, to avoid the effect of inductance; or, as Dr. Braun suggests, it may be attached to a metal plate having a large area. Now, let us suppose the closed oscillator S C C L is charged by the secondary of the induction coil J; when this reaches a certain critical potential a disruptive discharge breaks down the dielectric of the air at S, and in the restoration of the potential equilibrium oscillations occur, the frequency of which depend altogether upon the capacity, C C, the inductance of L and the resistance of the whole circuit.

If E is the potential difference between the coatings of the condenser, the intensity of the current caused by its discharge is as follows:

$$I = \frac{E - L\frac{di}{dt}}{R}$$

where R is the resistance of the enclosed circuit and L its inductance.

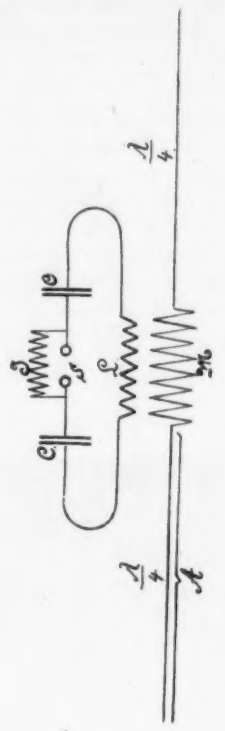


FIG. 1.—DIAGRAM OF BRAUN'S TRANSMITTER.

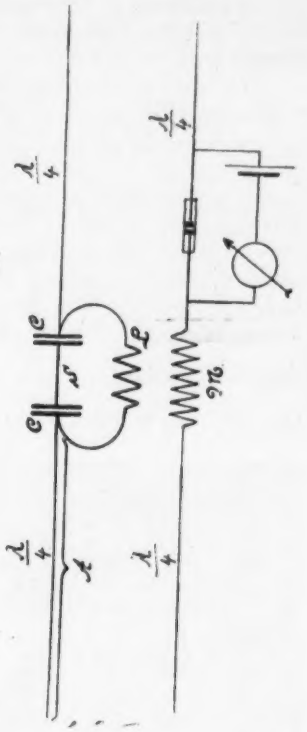


FIG. 2.—DIAGRAM OF BRAUN'S RECEIVER.

Furthermore:

$$E = \frac{Q}{c}$$

$$I = -\frac{a\,Q}{dt}$$

and we get by substitution of these values:

$$\frac{d^2Q}{dt^2} + \frac{R}{L}\,\frac{dQ}{dt} + \frac{Q}{C\,L} = O$$

The general integral by this equation is:

$$Q = A_1\,\varepsilon^{a_1 t} + A_2\,\varepsilon^{a_2 t}$$

and a^1, a^2 the roots of the equation:

$$L\,a^2 + R\,a + \frac{1}{C} = O$$

Thus:

$$a = -\frac{R}{2L} \pm \sqrt{\frac{R^2}{4L^2} - \frac{1}{LC}}$$

If the roots are real, *i. e.*,

$$R > 2\sqrt{\frac{L}{C}}$$

a continuous unidirectional discharge takes place. But if the roots are imaginary, *i. e.*,

$$R < 2\sqrt{\frac{L}{C}}$$

So likewise:

$$Q = \varepsilon^{-\frac{2L}{R}}\,(B_1 \cos \beta t + B_2 \sin \beta t)$$

$$\beta = \sqrt{\frac{1}{L\,C} - \frac{R^2}{4L^2}}$$

i. e., the discharge becomes periodic and alternate with maxima gradually decreasing in geometric progression.

$$T = \frac{2\pi}{\sqrt{\frac{1}{L\,C} - \frac{R^2}{4L^2}}}$$

[1] The Work of Hertz and Some of His Successors. Lodge.

[2] Electric Oscillations. Fleming, Society of Arts, 1901.

If $\frac{R^2}{4L^2}$ is small compared with $\frac{1}{L\,C}$, which is the case in Dr. Braun's closed oscillating circuit, because the arc of closure of the oscillating circuit consists of very heavy copper wire, and, therefore, the oscillations becomes very rapid, the period of which may be expressed thus:

$$T = 2\pi\sqrt{L\,C}$$

If L is measured in electromagnetic units (cm) and C in electrostatic units (cm), the wave will form this length as a natural sequence:

$$\lambda = 2\pi\sqrt{L\,C}$$

The oscillations set up in this closed circuit are now impressed upon the coil M by the lines of magnetic force linking the coils, and in order that this secondary coil may receive the maximum of intensity it is provided with additional conductors of suitable capacity and inductance, by means of which a regular reflection of the waves is produced. If, therefore, care is taken in damping the primary oscillator resonance effects are brought forth in the line of wave propagation, increasing the intensity enormously. Experiment and calculation have shown that these additional conductors, or, more exactly, resonators, must be equal to $\frac{\lambda}{4}$ or some multiple of it.

One of these additional conductors or resonators are now used as the antenna or vertical wire, by which the waves are radiated in space; the other is formed into a loose coil to reduce its length, or it may be replaced by an isolated plate of great surface.

The receiver is constructed on similar lines. It forms, to a certain extent a counterpart of the transmitter. Fig. 2 is a diagrammatic representation of the receiver. The electric waves impinging on the antenna A follow the reverse process of the oscillations set up in the oscillating systems of the transmitter; that is, they act on the open circuit first and a reaction takes place in the closed circuit, which is pitched down to the length of wave sent out by the transmitter. Here another addition $= \frac{\lambda}{4}$, thus providing the proper resonance, so that strong oscillations may again be produced in L. The latter is now transmitted to M, and by means of the additional conductor $\frac{\lambda}{4}$ a regular reflection is produced in M with great intensity. The additions $\frac{\lambda}{4}$ may here, too, be replaced to advantage, and in far simpler form by plates of a large surface.

With this abridged description of Prof. Braun's theory the construction of his apparatus for fulfilling the theoretical requirements will now be treated briefly.

The transmitter may be divided into two groups of apparatus (a) the inductor with its auxiliary appliance, and the (b) the oscillating systems necessary to excite the antenna. The secondary of the induction coil is wound with comparatively thick wire, and is constructed in such a manner that the magnetic lag of the iron coil effects but a slight reaction on the secondary current. The result of this is that the potential difference at the terminals of the secondary current thus derived is extremely suitable for the heavy loads of capacity that may be required to effect a given periodicity of oscillation, since it is well arranged for a small time-constant of the charged circuit. The inductor or primary winding of the coil is quite long considering the secondary winding, but this gives the latter a minimum resistance. The cross-section of the secondary coil is fairly large, reducing the danger of heating to a minimum. The proper insulation of the coil has been given much consideration and is nearly double that of the ordinary forms, which insures the working of the coil without trouble even in moist places.

The circuit breaker Prof. Braun prefers is a modified form of the (Wehnelt) electrolytic interrupter, known as the Simon interrupter, the principle of which has been so thoroughly demonstrated as not to require further consideration here. Suffice it to say that the one furnished by Siemens and Halske has been simplified, and its construction is such that after the first interruption it is not necessary to alter the e. m. f.; the explosions, which formerly took place so often, are rendered impossible by the addition of a diaphragm in the cover, preventing the upper electrode forming the internal pole of the diaphragm from coming in contact with the acid vapors, and always remaining separated from the secondary pole through a perfectly dry porcelain layer. The mixing and ignition of the electrolyzed gases is eliminated by this arrangement.

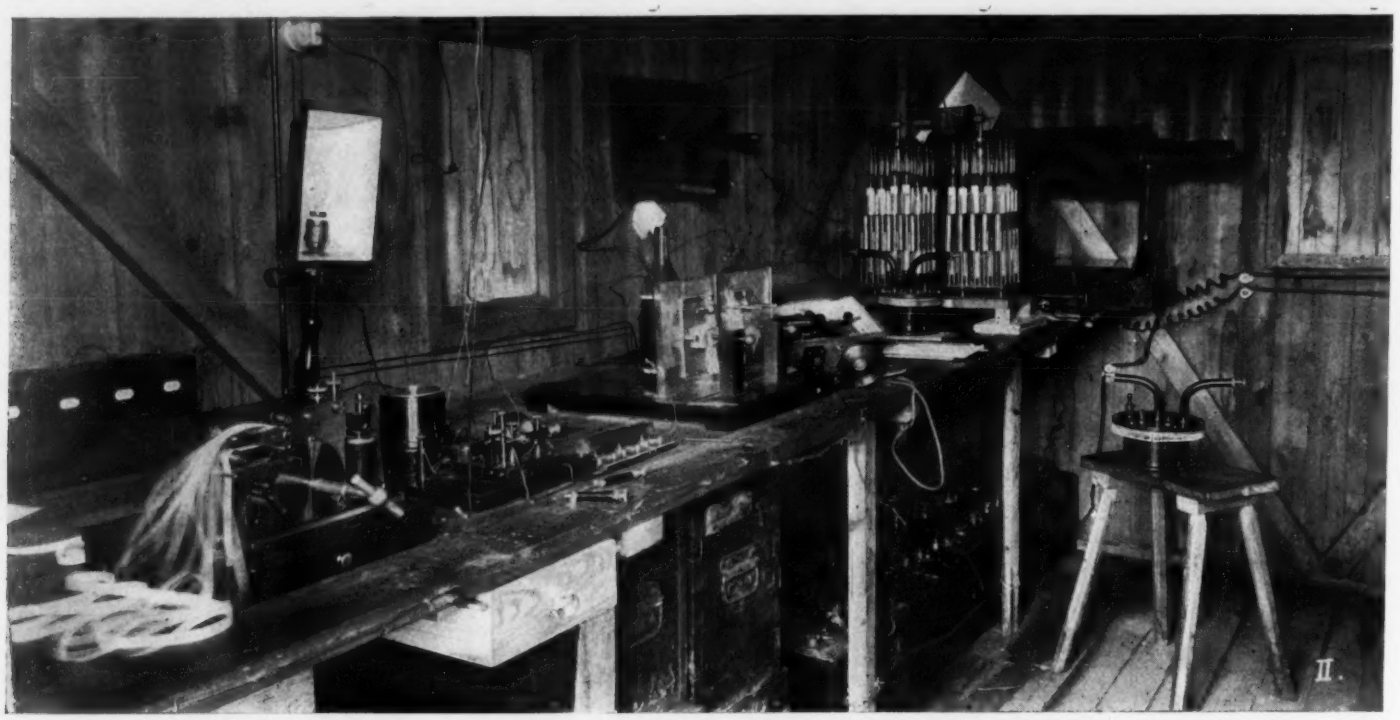


Fig. 3.—Interior of Prof. Braun's Wireless Telegraph Station, Heligoland.

If a low-voltage current is the only available source of energy, the electrolytic interrupter cannot be used; and in such cases a mercury radial interrupter is substituted. Though the break of the mercury interrupter is not as sudden as that of the electrolytic type, it is capable of satisfying every demand and requirement in wireless telegraphy. The platinum interrupter has been universally discarded by the makers of wireless telegraph apparatus, since it does not possess sufficient lasting qualities to meet the requirements for continued operation, and the Siemens and Halske company do not any longer recommend either the "Deprez" or the "Wagner-Haumer" device formerly supplied.

For the production of the Morse code, a key of special construction is inserted in the primary circuit. To be able to work with a large volume of current, as may be accomplished by the use of the induction coil of Prof. Braun, an improvement was made in the Morse key or "manipulator," according to the literal translation, hereto-

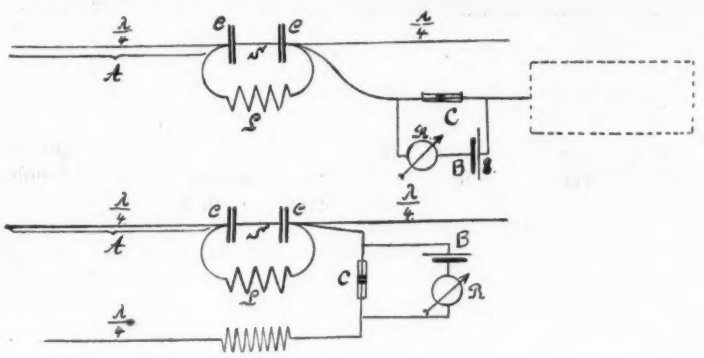
fore employed, which enables the operator to make and break currents of even 50 amperes into dots and dashes, and without danger to the interrupter. For the consummation of this purpose the circuit is made at a point distinct from where it is broken, a device having been invented, so that the place where the break is made always closes first and then the principal contact. This contact, however, opens first in the interrupter, and but one exit is left for the current, and that is through the discharge. The principal contact always remains sparkless, in consequence of the arrangement of the discharger, which is provided with carbon contacts and a magnetic spark extinguisher, so that the interruption may take place with the least difficulty and with the ordinarily required rapidity. The carbon contacts are supplementary and may be replaced when they are consumed.

The closed oscillating system consists of (1) a series of Leyden jars, and (2) a transformer. To bring within as small a space as possible the greatest capacity area, the tubular form was devised by Prof. Braun. The tubes are made of glass, having a diameter of 25 mm., and are 2 mm. in thickness. They vary in capacity, some of them measuring 0.0004 microfarad to 0.0005 mf. and may be quickly replaced, since all that is necessary is to slip them into the rack as shown in the photograph, Fig. 3, if they should be broken either mechanically or electrically. Reserve tubes are supplied with each set of apparatus. These cylindrical condensers also have the advantage of interchangeability within the limits of 0.0002 m's to 0.0048 m's, and in steps of 0.0002 m's. and the period of oscillation, and, therefore, the wave length is variable in its greatest limits.

The primary winding of the transformer is carefully designed so that it will give the desired wave length together with the greatest capacity. The wave length to be used should be selected, and the apparatus so adjusted that the height of the antenna should be one-fourth its length. The secondary winding is adjusted according to the wave length used, but it must be regulated in connection with the air wire. As the high-frequency, high potential currents set up in this transformer are powerful it is immersed in oil. The diameter of the transformer is 20 cm.

The receiving apparatus is shown to the extreme left of the engraving, Fig. 3. Notwithstanding that the receiver is in construction quite similar to the transmitter, no such powerful oscillations occur in it as in that of the emitter, hence the condenser of the closed circuit oscillating system may be of much smaller dimensions than the one of the transformer just described. In the cut, the oscillating system for the reception of wave lengths of 200 meters is shown.

As the coherer is the vitally essential part of the wireless telegraph system, Prof. Braun has given considerable attention to its development, with the result that he has introduced an innovation in the art by designing one that does not require to be exhausted. He contends that experiment has not shown that the vacuum coherer is more sensitive than unexhausted ones are. It is certain that a vacuum



FIGS. 4 AND 5.—BRAUN'S NON-SYNTONIC RECEIVERS.

coherer is extremely difficult to keep in adjustment, and is practically worthless when it becomes deranged. The ease with which Prof. Braun's coherer may be restored to its initial state of sensibility appeals to technician as well as the practical operator of wireless systems. It may be taken apart, replaced and adjusted in a very short time by any one. The conductor plugs are of steel and the ends forming contact with the filings must have a good polish. The filings consist of hardened and sieved steel powder. The sensitiveness is about the same as the best vacuum silver-nickel coherer, and its accuracy much greater, that is to say, it is not as susceptible to atmospheric disturbances. Its sensitiveness may be increased—at the expense of accuracy—by using rougher steel filings. One of the greatest points in favor of Prof. Braun's receiver is that it is exceedingly strong and cannot be broken, as can the fragile glass forms, and can never wear out.

Prof. Braun has made the observation that the steel-filings coherer does not respond as quickly and is not as reliable when the conductor plugs become magnetic; but that a certain critical magnetism increases its sensibility, without injuring its accuracy to any appreciable extent. These observations resulted in a magnetic regulator, eliminating the lag and uncertainty of the action and increasing the sensitiveness. This regulation is done by means of a permanent ring magnet, and placed between its poles are the conductor terminals of the coherer. By rotating the ring magnet, the north or south poles

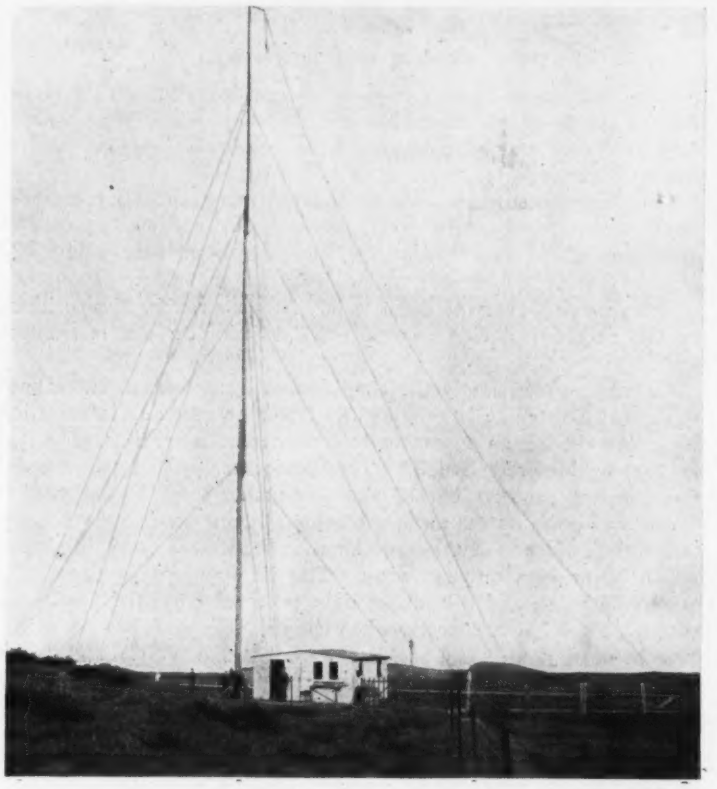


FIG. 6.—BRAUN'S WIRELESS TELEGRAPH STATION AT CUXHAVEN.

may be brought as near to the ends of the terminal plugs as desired, and the ends are magnetized or demagnetized to any extent desired. It will not be necessary to go into detail as to the connections of the tapper relay and Morse printer, as in all systems there is little variability.

If a tuned wireless telegraph is not required, the receiving system may be arranged in a more simple manner. This may be done by removing the transformer or by allowing it to co-operate. Thus two other receiving systems result, as shown in the diagrams, Figs. 4 and 5. In the case represented in Fig. 4, where the transformer is rejected, one of the conducting plugs of the coherer is connected directly to the closed circuit oscillator, as shown, and the opposite conductor plug is attached to a plate of metal having a large capacity. In the following case, Fig. 5, the transformer is used without reference to resonance; here one of the conductor plugs is connected to the oscillator circuit, and the other to one terminal of the secondary of the transformer. In either of these forms resonance effects are difficult to obtain, but when the connections shown in Fig. 2 are used the intensity of the impinging waves is such that primary resonance like that in acoustics is brought about.

Another class of instruments have been designed by Prof. Braun for portable use, where writing is not essential and greater rapidity is desired. In this system a telephone receiver is employed instead of the more cumbersome apparatus in the standard stationary sets. The regulation type, however, is much more accurate, and is to be preferred to the latter.

Fig. 6 shows the station at Cuxhaven, Germany. Another station is located at Heligoland, in the German Ocean, 36 miles away, and has been tested in all sorts and conditions of weather, and has answered the fullest expectations.

Some Notes on Synchronizing.

By Joseph Martin Roman.

SINCE the day when two alternators were required to run in parallel on the station load, the question of synchronism has been one of importance to the electrical engineer. Hopkinson, Mordey and others, by their classic experiments have long since pointed out the requirements for successful operation, which have been met by alternator designers. Engine builders have so far perfected the methods of governing that mechanical regulation can be depended upon to insure an equitable and practically steady division of load. Consequently, once alternators are properly synchronized and made to share the station load, they can be depended upon to maintain these conditions constant.

METHODS OF INDICATION.

Lamp indications have always been regarded as the most favorable for synchronizing determinations, the lamps being either light or dark at the critical moment—the latter condition being adopted in America, European practice being the other way.

Many other methods have been proposed. One, an audible method, making use of two resonators, whose emitted notes coincide at synchronism. Another device is an instrument consisting of a combination of a voltmeter and a frequency indicator, having two pointers moving over the same scale. At synchronism the positions of the needles coincide over a marked point on the instrument scale.

As lamps show simply the condition of synchronism, but cannot show which machine is running the faster or give any information regarding the lag an apparatus to indicate the latter was presented in 1894 by Moler & Bedell.* This device consists of two coaxial discs, having properly curved slits in number equal to the number of pairs of poles on the machines being synchronized, and revolving under the influence of these machines in front of a fixed disc, upon which latter is a circular scale. The intersections of these slits appear as holes, and a beam of light reflected from the fixed disc, through these holes, appears, when the movable discs are revolving, as a band of light. The position of this band over the scale gives the angle of lag, the inward or outward movement of the band indicates the relative speed of the machines, and the absence of light denotes the position of synchronism.

Incandescent lamps are now relied upon for synchronizing, though on large boards generally in connection with a voltmeter indication. In many cases a voltmeter alone is used, which is often a special two-scale instrument, one scale reading zero and the other full voltage at the synchronous condition. By properly controlling the circuit, the machine voltmeter may be connected to indicate synchronism, or a special voltmeter may be used, with or without lamp indications. In cases of this kind, the voltmeters used are mounted on the machine panels, there being one for each alternator. On many large boards one synchronizing voltmeter is used and mounted on a swinging bracket at the end, the synchronizing circuit being so controlled that the voltmeter may be thrown between the bus-bars and any starting machine. If a lamp indication is also used the lamp should be placed on the swinging bracket above the synchronizing voltmeter, and there will usually be another lamp in series with this one, placed on the front of the machine panel.

DESIRABLE CONDITIONS.

Synchronizing circuits are always of low tension, and hence usually involve potential transformers. Evidently, to secure a method of control admitting of a variety of connections, some flexible switching system which will reduce the liability of error to a minimum is necessary. If separate devices for each machine are to be used, the most desirable arrangement is such that when starting up the only voltmeter or lamp which indicates is the one on the panel of the machine starting. The advantage of this is that the attendant has his attention attracted only to the panel on which his controlling switches are placed. In some cases, however, a lamp in series with the one on the machine panel is placed on the engine driving that machine, thus giving an additional indication to the engine attendant.

Large station boards are usually designed with a station panel for measuring the total energy delivered, which is placed between the generator and the feeder panels. A switching device on this panel in connection with a similar device on the panel of the starting machine should make such connection in the synchronizing circuit that proper indications will be given only on the machine panel, or on the devices arranged on the swinging bracket; and such connections must be possible from any machine panel. If such station panel is not provided, the starting machine is synchronized with any of the running machines, which, however, amounts to the same thing as synchronizing from the station bus-bars.

THE SYNCHRONIZING CIRCUIT.

Behind the switchboard, synchronizing bus-wires (two or three in number, of No. 8 wire, with rubber insulation) are run, supported on black fibre supports, which last are usually bolted to the iron angles supporting the board. Connections are made between these bus-wires and the synchronizing switching devices on all panels. These switching devices may be of varied design, but the use of plugs fitting into receptacles on the front of the panels has much in its favor, and seems to be the most desirable system.

The receptacle consists of a number of brass tubes (the number depending on the requirements of the case) fitted into small holes in the panel, and terminating behind in a stud, on which fit a small terminal and a nut. Circuit connections are made by means of the terminal, and the whole is held in place on the panel by the nut.

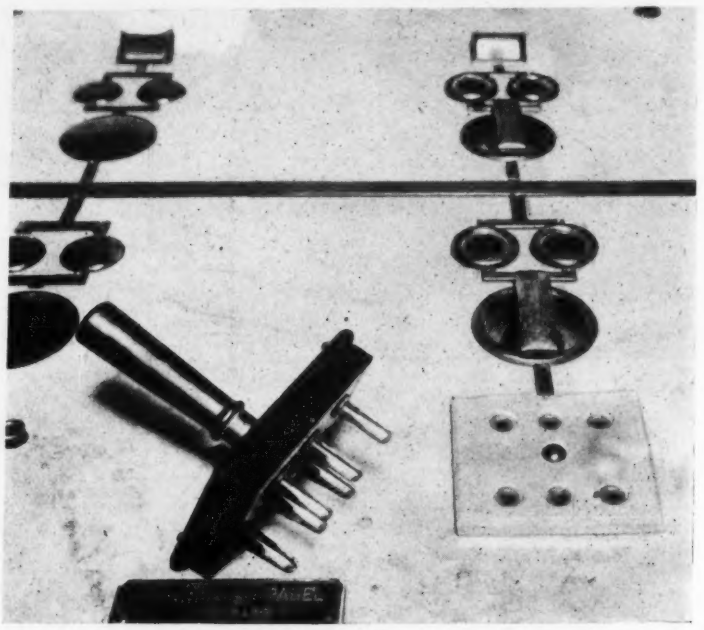


FIG. I.—PLUG AND RECEPTACLE.

The plug consists of a rectangular piece of black fibre supporting a number of split brass rods, corresponding in number and arrangement to the tubes in the receptacle, into which they fit. These brass rods are properly connected together by copper strips laid in recesses in the fibre supports. A cap of polished hard rubber is then screwed over the fibre, this being marked with a diagram of the concealed connections of the brass rods, and a handle is then secured to the plug. When a plug is intended for a special purpose a nameplate fastened to it defines such use. Evidently extreme flexibility, allowing a great variety of connections, is the main advantage of this system; moreover, all live portions are well insulated, and the circuit connections are readily seen.

When lamps are used for synchronizing, either light or dark, the number of lamps in series should be the same as would be placed on a circuit of voltage double that of the synchronizing circuit. However, on many alternating lines whose voltage is lower than that for which commercial potential transformers are designed, and yet so high as to require an inconveniently large number of lamps, special resistances are used to take care of the extreme voltage when the machines are out of step. One lamp only is mounted on the front of the panel, and any additional lamps that may be required are placed behind the board. The question of light or dark synchronizing is taken care of entirely by the form of plug used. If all connections on the alternator panels are similar, then similar plugs synchronize dark; and plugs with dissimilar connections will synchron-

* *Transactions* A. I. E. E., Vol. XI, pp. 502.

ize with lamps bright. The simplest connection, using only lamps, is shown in Fig. 2.

For rotaries which start up inverted, the lamps are placed across the main switch, and usually three lamps are placed on the front of the panel, one of which is in each phase.

At synchronism the lamps are all dark. If the rotation of the phases of the rotary is the same as that of the circuit from which it is to be operated, the lamps pulsate together; if, however, the phase rotation of the rotary be reversed—for instance, when the rotary is first started or improperly connected—the lamps will then not be in darkness at the same instant, but in succession. It is for this reason that three lamps are required.

In the selection of a synchronizing arrangement much depends on the taste of the engineer, and special scale voltmeters are made

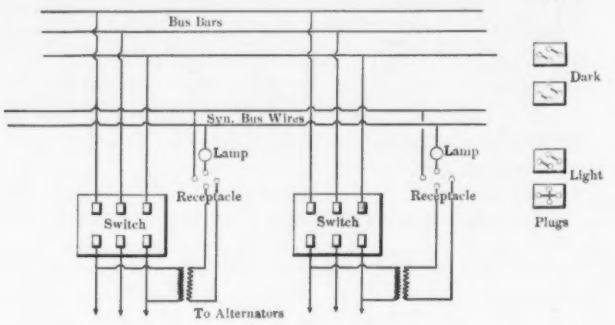


FIG. 2.—SIMPLE CIRCUIT.

to suit all requirements. The usual points on the voltmeter scale at which the needle rests at synchronism are zero, normal and double normal voltage; but wherever the critical point may be, it is desirable to have large scale divisions in the neighborhood of this position.

On many high-tension, three-phase circuits—usually where both lamps and voltmeter are used—two transformers connected to three phases (as shown later) are necessary. The resulting synchronizing circuits are highly ingenious, but would be complex in wiring were it not for the expedient adopted of grounding the common connection on the low tension side of the two transformers. This is both a matter of precaution and tends greatly to simplify the connections. The most widely used of these arrangements are considered in detail.

The connections of a high potential machine synchronizing with the bus-bars, using a lamp and a special voltmeter, are shown in Fig. 4. The connections of the plug are as shown, and but one plug is necessary. If it is inconvenient or undesirable to use a special volt-

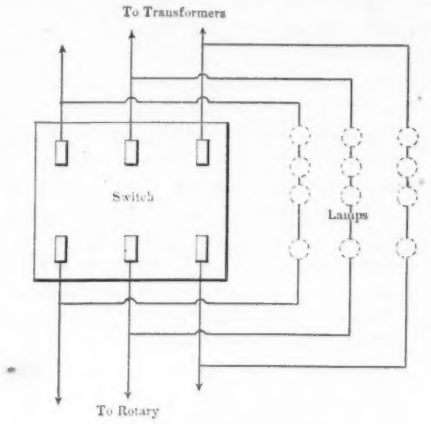


FIG. 3.—ROTARY CIRCUIT.

meter, the machine voltmeter may be used for synchronizing by arranging the proper connections. It is only necessary to insert one plug in the panel of the machine starting to secure proper synchronizing connections, and when the alternator is on the bus-bars another plug is necessary for ordinary voltmeter reading. The connections and plugs are shown in Fig. 5.

In both this and the preceding arrangement the most favorable conditions for observing synchronism are obtained, namely, lamps dark and votmeter-needle steady at normal voltage. For synchronizing, but one plug is necessary, and the operator can confine his entire attention to the panel of the starting machine. Moreover, though two potential transformers are connected to bus-bars, but one is necessary on each machine panel.

The connections shown in Fig. 6 are those of two high-potential machines, synchronizing with each other, using a lamp and a special voltmeter. Two plugs are necessary, connected as shown, and only

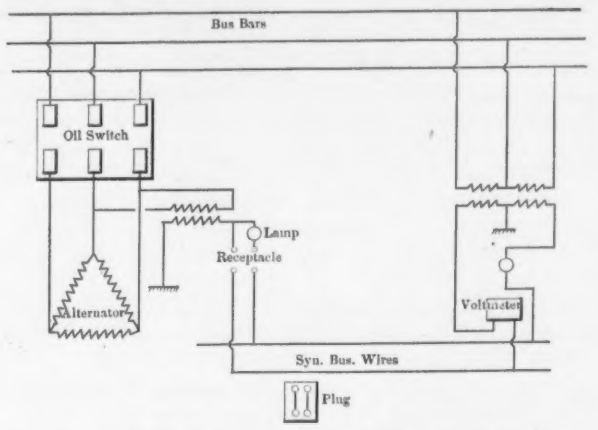


FIG. 4.—HIGH-POTENTIAL SYNCHRONIZING CIRCUIT.

one voltmeter and one lamp, mounted where they can be readily seen, as on a swinging bracket, are required. Synchronism is shown by the lamp being dark and the voltmeter needle steady at normal voltage. With some slight additions, this is the scheme adopted for synchronizing the alternators of the new Manhattan Railway in-

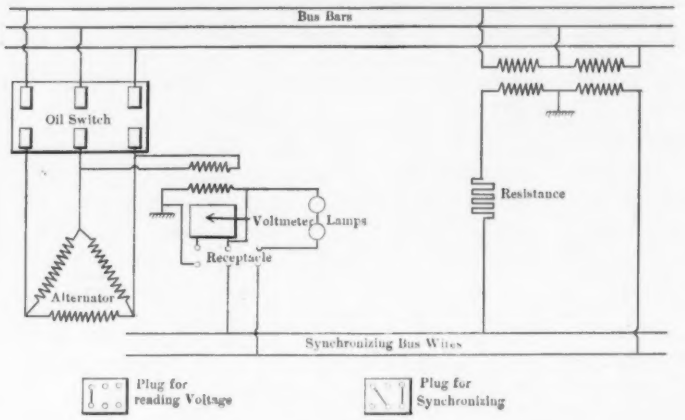


FIG. 5.—HIGH-POTENTIAL SYNCHRONIZING CIRCUIT.

stallation in New York City. The voltmeter is a special two-scale instrument, the needle of one scale being at zero and that of the other scale at normal voltage at the critical instant. This voltmeter is mounted on a pivoted frame at the center of the upper edge of the generator controlling table. Two lamps in series are used (being

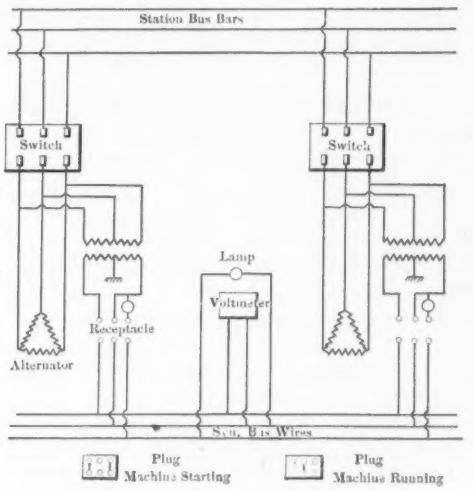


FIG. 6.—SYNCHRONIZING CIRCUIT FOR TWO HIGH-POTENTIAL MACHINES.

dark at synchronism), one mounted on the top of the special voltmeter and the other on the engine driving the starting alternator. The connections of this arrangement are shown in Fig. 7.

A modification of the foregoing scheme, using the machine volt-

meters to indicate—the machines synchronizing with each other—is shown in Fig. 8. The proper plugs being inserted, the critical point is shown by the lamp being dark, the voltmeter then indicating normal voltage on the panel of the starting machine. When running, a third plug is inserted for voltmeter indications. This arrangement is largely used, especially on the switchboards in stations of

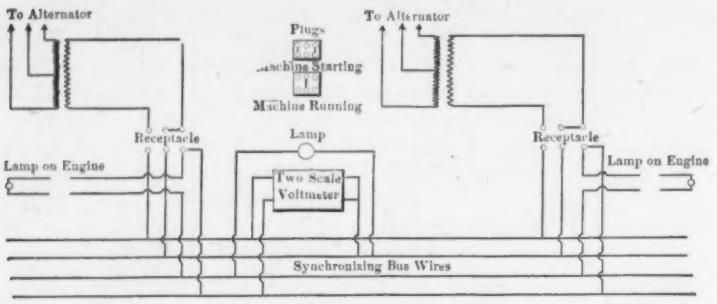


FIG. 7.—CONNECTIONS OF SYNCHRONIZING CIRCUIT OF FIG. 6.

long electric railways. The extreme flexibility is its main advantage, as it allows alternators and rotaries to be synchronized with the line or with each other.

In Fig. 9 is shown an arrangement involving special synchronizing voltmeters, one for each alternator, the instruments reading double normal voltage on the starting machine panel when the machines

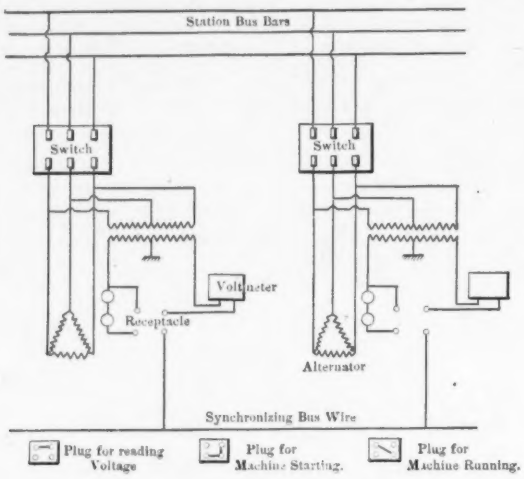


FIG. 8.—MODIFICATION OF FIG. 6.

are properly in step. The machines in this case operate on a four-wire, two-phase circuit.

The most recent form of synchronizing indicator, and one which does not make use of lamps, is the Lincoln synchroscope, the construction and the operation of which have already been fully described.* The accompanying diagram, Fig. 10, shows the circuit

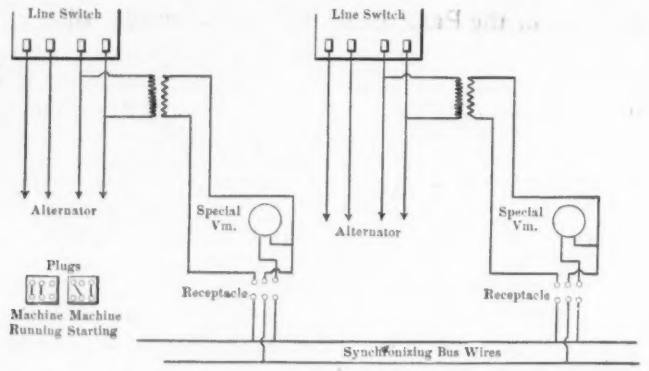


FIG. 9.—TWO-PHASE, FOUR-WIRE SYNCHRONIZING ARRANGEMENT.

arrangement in connection with lamps, which are here used as an auxiliary indication.

As will be noted upon a study of modern switchboard methods, the tendency exists to make the entire operation of switching a generator on or off the line, automatic, the actual connections being shown visually. The most recent switchboards require a synchronizing circuit to indicate the conditions to the eye, and the generator switch is closed through the agency of a secondary electrical circuit, controlled by a snap switch on the generator panel. Recent patents, however, from which the trend of development may be

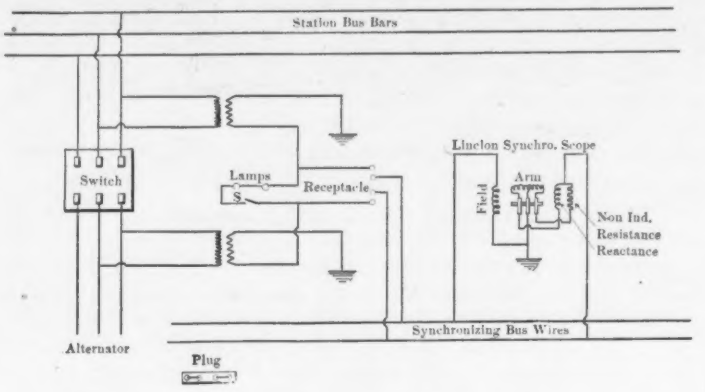


FIG. 10.—LINCOLN SYNCHRONIZER WITH LAMP CIRCUIT.

noted, make a still more radical step than this, for by properly connecting the synchronizing-circuit direct to the line-switch controlling circuit the operation of closing the generator switch at synchronism can be made completely automatic. It is simply necessary to maintain the proper condition, namely—that the voltage and period of generator and line should agree for an appreciable length of time before the switch is closed, and this operation is satisfactorily accomplished.

* Vol. 38, No. 9.

Long-distance Wireless Telegraphy and Hertzian Waves.

BY EDWARD P. THOMPSON.

SOME personal experiments in conjunction with those already on record in scientific literature, lead me to conjecture that long-distance wireless telegraphy is not operated by aerial Hertzian waves. I submit an argument tending to prove this statement.

A simple and well known experiment consists in placing a coherer at the end of a long wire, the other end being charged by a spark discharge. This wire may be miles long, and even hundreds of miles long, and the spark comparatively small, and yet the coherer will be effectively operated. I do not explain the details of this experiment, because they are too well known. I mention it simply to call attention to the fact that writers have erroneously, I think (and I have myself done so), assumed, intimated and stated that the coherer in such a case is operated by Hertzian waves. Of course, for a short and direct enough distance, Hertzian waves would be radiated from the spark and act upon the coherer, but suppose the long wire should be conducted around corners of streets and end up behind a huge metal wall through which no Hertzian waves could pass? The coherer would still be operated, but not by Hertzian waves. It would be operated by an oscillatory current conducted by the wire around the corners and to a point behind the metal wall. In wireless telegraphy, a river or bay or ocean, or moist earth takes the place of the long wire. Hence, a coherer is operated in wireless telegraphy by an oscillatory current conducted by a solid or liquid or other conductor, or if you prefer, by the ether in or on or near the conductor. I have conducted an oscillatory current over a wire hundreds of times further than Hertzian waves, from the same spark, could travel. Marconi, therefore, operated the coherer at a distance of 1,500 miles by the conduction of an oscillatory current over the surface of the good conductor—salt water. The Hertzian waves had nothing to do with that wonderful feat. The Hertzian waves, if they can travel through air 1,500 miles, were above Marconi to the enormous vertical distance of about 16 miles. Why? Because Hertzian waves are radically different from oscillatory currents, as far as has been proved. Is it necessary to repeat the definitions of the nature of Hertzian waves? Is it necessary to argue that oscillatory currents on a wire are not radiations moving in a straight line, especially if the wire is zig-zag, or that such oscillatory current has not yet been refracted or reflected while on the wire? When this oscillatory current leaves or separates from or departs from a conductor, it is no longer a current,

simply because it is not conducted, but travels without a conducting medium. Then are aerial Hertzian waves produced. This is a backhanded kind of definition, but still I think it serves to distinguish aerial Hertzian waves from oscillatory currents. As far as their inherent natures are concerned, both are, broadly speaking, identical, both consisting of vibrations of ether, but specifically, aerial Hertzian waves are rectilinear radiations through space, without a conductor, capable of reflection, refraction, interference and polarization, and a coherer, to be operated by such radiations must be in their path. Hertz was the discoverer of and demonstrated the fact of these radiations. This kind of radiation was novel with him as far as absolute proof was concerned; but he did not discover nor demonstrate that oscillatory currents are transmitted along a conductor. This fact is almost as old as Franklin's kite wire.

By bearing in mind, therefore, all the experiments performed thus far, and the argument herein, it seems to be fair to conclude that it is pretty clearly demonstrated that Hertzian space or aerial radiations did not operate the coherer in the 1,500-mile accomplishment of Marconi.

As to overcoming objections to this argument, it should be remembered that no one knows everything there is to be known. Some one may ask, why are aerial wires necessary, if only conduction is the explanation? I answer this by asking, why did early experimenters think it essential that the receiving aerial wire must be high enough to be in the unobstructed line of sight of the transmitting spark? Now we know that the top of the aerial wire may be miles below where the rectilinear radiations ought to be.

The aerial wires, in the absence of aerial waves, may be explained as acting as a capacity, by which the oscillatory earth current is conducted through the coherer. The longer the aerial wire and the further from the earth, the better, up to a certain maximum. The receiving aerial wire not only acts as a capacity to conduct the oscillatory current through the coherer from the earth (instead of from the atmosphere to the earth as heretofore explained by most investigators), but it serves, especially when not terminated by a ball, to dissipate the charge, in a manner similar to that of points on a frictional generator, in which smooth, rounded surfaces, without points, are always used to avoid the leakage or discharge.

I have noticed that writers have tried to explain that these radiations may travel in curved paths by following the water, instead of stating what seems to be clear, that there is not simply one form of energy given off by the spark, but two distinct forms. One form is the ray or series of waves or radiations, traveling, as Hertz showed conclusively, as true radiations, independently of a conductor, and apparently are best transmitted in the absence of both insulators and conductors. They are stopped by metals and absorbed by all substances more or less. I think it has not yet been shown whether these waves really do travel very far before being absorbed, diffused and exhausted in various ways, by transformation into heat, etc. Possibly they do not travel further than that distance at which a coherer is operated without an earth connection and aerial wire. I find that these adjuncts can be omitted only at an enormously reduced distance.

The other force generated by a spark besides the rectilinear radiations is the oscillatory current known long before Hertz, and is now probably the force serving to transmit messages in long-distance wireless telegraphy.

Let me offer an analogy, not to intimate any identity but to illustrate that there are similar distinctions in other departments of science. Take the case of sound. When one puts his ear to a railway tracks, and hears a train too far away to see it, and too far away to hear it, by air vibrations, we have a case similar to a coherer connected to earth, too far away from the spark for receiving rectilinear and much weaker Hertzian etheric waves.

The engineering feature is therefore observed, not in trying to obtain a rectilinear path from the spark, but in securing the best possible conductor, like salt water, or a river, and to avoid frozen or dry ground. A cable itself has been proposed, as the coherer is more sensitive than the Thomson mirror galvanometer apparatus.

If these arguments hold, then long-distance wireless telegraphy is due entirely to conducted oscillatory currents.

Further experimental proof would consist in attempting to refract and reflect the Hertzian waves at long distances. I have attempted this on a small scale. I do not think the true aerial Hertzian waves will be found far enough for long-distance wireless telegraphy. Reflectors and other concentrators for the supposed aerial radiations seem to have been abandoned at the receiving station.

In performing experiments to test the distance to which aerial Hertzian waves may be transmitted, care should be taken not to mistake secondary or local aerial Hertzian waves for those originally transmitted from a distance. I do not remember that Hertz took into account the radiations from the spark produced in his receiving resonator. The caution should aim at the origin of this secondary spark, to discover whether it is produced by a conducted oscillatory current or by aerial Hertzian waves. If a coherer is employed instead of a Hertzian resonator, the same precaution should be taken, for I have learned that a coherer will also generate weak aerial Hertzian waves.

Several practical considerations follow, if my conclusions are correct. Inventors are now working upon the assumption that the coherer and aerial wires are actuated by aerial Hertzian waves. They assume this to be so, regardless of short or long-distance wireless telegraphy. Many syntonizing systems, as I learn from patents and other literature, are based upon the action of aerial Hertzian waves, which if any, are probably a mile or more above the top of their receiving aerial wire. This provision would be like foolishly connecting one ear to an ear tube, and the other to a speaking tube. Tuning systems for long range should be based upon the fact of an oscillatory current conducted over an electric conductor. Incidentally, some tuning systems intended for aerial Hertzian waves will operate

DIAGRAM OF TWO TRANSMITTING ENERGIES.

for oscillatory currents, but they were invented to answer only to aerial Hertzian waves.

In one sense, the oscillatory current consists of waves corresponding to Hertzian waves. The nomenclature most exact would be probably, "aerial Hertzian waves" for those transmitted through the atmosphere, and the old term "oscillatory current" (instead of "Hertzian waves") for those waves which may be and are conducted in any direction by a wire, and in all horizontal directions by the earth.

The accompanying diagram serves to indicate the two distinct transmitting energies in short and long-distance wireless telegraphy. The curve represents the conducting surface of the ocean or earth or the path of the oscillatory current. The alternate dots and dashes indicate the rectilinear path of aerial Hertzian waves. At short distances, both forces act upon the coherer. At long distances, only the oscillatory current acts. The short radial lines indicate the aerial wires of the transmitting and receiving stations, respectively. Although so short, they are several miles high, the length of the curve between the aerial wires being about 1,500 miles. It would need too large a sketch to show the true proportion, but in such a sketch the aerial Hertzian waves would appear higher yet above the receiving station.

Success of the Paris Electric Underground Railway.

At the annual meeting of the Paris Metropolitan Railways, the report for 1901, then submitted, covers the first full year in the company's history. Only one line is as yet operated. The number of passengers carried on the Paris Underground during 1901, which was 48,478,116, is almost exactly one-fourth the traffic on the four Manhattan elevated lines. Gross receipts of the Paris line for 1901 were: $1,710,000, as compared with $9,416,887 on the New York elevated lines. Receipts from advertising, etc., brought the year's total revenue up to $1,710,000, from which has to be deducted the working expenses, taxes and maintenance, amounting to $806,500, leaving a gross profit of $903,500, of which the City of Paris, which constructed the lines, received $555,600. To the balance of $348,000 has to be added $64,700 for interest, etc., and the balance carried over from 1900, making a disposable sum of $412,500. Shareholders receive $300,000 in a dividend of 15 francs, or 6 per cent. of the capital in shares of 250 francs, at which price they were taken by a syndicate. Of the remaining net profits of the year, $19,400 was added to the reserve fund and $19,400 paid to the directors. The proportion of working expenses to receipts was 47.16 per cent.

Electricity on Warships—II.

(Concluded.)

IN the paper read by Lieut. Harry George before the recent special May meeting of the American Institute of Electrical Engineers, the general subject of electrical installations on warships was considered under various headings. In last issue the subject of dynamos was taken up. The following relates to the generator, wiring, signalling, lamps, etc.:

GENERATOR.

The specifications require that the generator shall be of the direct-current, multipolar type, compound-wound, long-shunt connection, designed to run at constant speed and to furnish a pressure of 125 volts at the terminals, at rated speed, with load varying between no load and one and one-third times rated load.

The magnet yoke or frame is circular in form, having inwardly projecting pole pieces, and divided in half horizontally, in all generators above 5-kw capacity, the two halves being secured with bolts, to allow the upper half with its pole pieces and coils to be lifted to provide for inspection or removal of armature. Facilities for vertical adjustment of frame are provided in sizes of 16 kw and above.

The testing voltage for sets under 16 kw is 1,000 volts, and for sets of 16 kw and above is 1,500 volts, the source of the alternating e. m. f. being a transformer of at least 5-kw capacity for sets of 50 kw and under, and of at least 10-kw capacity for sets of greater output than 50 kw.

The test for dielectric strength is made with the completely assembled apparatus and not with its individual parts and the voltage applied between the electric circuits and surrounding conducting material. The tests are made with a sine wave of e. m. f., or where this is not available, at a voltage giving the same striking distance between needle points in air, as a sine wave of the specified e. m. f. During the test, the apparatus being tested is shunted by a spark gap of needle points set for a voltage exceeding the required voltage by 10 per cent. With brushes in a fixed position there must be no sparking when load is gradually increased or decreased between no load and full load; no detrimental sparking when load is varied up to one and one-third times rated load; no flashing when one and one-third load is removed or applied in one stage. The jump in voltage must not exceed 15 per cent. when full load is suddenly thrown on and off.

The cross-compound type of engines is now used exclusively in the new installations for sets above 8 kw. Following are the details of a multipolar 8-pole, 24-kw, 400 r. p. m., 80-volt generating set, manufactured by the General Electric Company, for U. S. S. "Olympia." Weight, 9,385 lbs., complete; extreme length, 84 in.; extreme width, 52 in.; extreme height, 77½ in. over all. Number of cylinders, 2; cranks at 180 degrees. Inertia governors; steam pipe, 2½ in.; exhaust pipe, 4 in.; diameter cylinder high pressure, 7½ in.; diameter low pressure cylinder, 12 in.; stroke, 8 in. Dynamo dimensions: Volts, 80 degrees; amperes, 400; r. p. m., 400; pole, 8; number of carbons per brush, 1; dimensions of brushes, 1¼ in. x ⅝ in.

The heat run was for 4 hours at 394 amperes. Terminal volts, 81.8 to 81.5; steam, 100 lbs.; vac., 22 to 21.5; r. p. m., 406; temperature air 28.2° C. at beginning, 30.2° C. at end of run. Temperature at end of heat run: Armature core surface, 51° C.; commutator bars, 55.5° C.; pole tip leading, 47.5° C; pole tip trailing, 48° C.; main bearings, 52° C.

Overload run, two hours at 33⅓ per cent. overload. Temperature of air during run, 30° C. Temperatures at end of run: Armature core surface, 59.5° C.; commutator bars, 59.5° C.; pole tip leading, 53.5° C.; pole tip trailing, 54° C. Average water consumption during four-hour heat run, 33.6 per kw-hour.

The output and efficiency were as follows: $I^2 R$ brush, 768 watts; $I^2 R$ armature, 1,600 watts; $I^2 R$ series, 422.4 watts; C. E. shunt, 753.3 watts; core loss and friction, 1,637 watts; total losses, 5,180.7; volts, 80; amperes, 400; input, 32,000 watts; losses, 5,180 watts; outputs, 37,190.7 watts; efficiency, 86 per cent.

All wires for feeders, mains and branches are installed in enameled steel conduit except in passages and dynamo rooms, when not exposed to mechanical injury, when porcelain racked hangers are allowed. Molding is no longer used except in officers' quarters or over hard wood surfaces, for the sake of appearances. All feeders run below the water line as far as possible. Thorough water-tightness is observed for all leads into wiring appliances and fixtures and through all water-tight decks and bulkheads.

The conduit is secured to the metal of the ship by stout metal straps, and the wiring appliances are usually supported in place by the conduit. Conduit is made water-tight internally when necessary to prevent the flow of water from one compartment to another. For wire of below 60,000 cm, cross-section twin conductor is run in the same conduit; above this size, two leads of conduits are used, one for each leg.

Circuits are divided into three classes, each being entirely distinct from the others: (1) Search-light circuits; (2) lighting circuits; (3) motor circuits.

Each search-light is provided with a separate feeder from switchboard through a double pole switch, fused, rheostat, ammeter and double pole automatic circuit-breaking device direct to terminal lead of search-light pedestal. A rheostat in a non-combustible frame is supplied for each search-light. The rheostat has a dead resistance which, when heated, gives a drop of from 55 to 65 volts, and also an adjustable portion in not less than ten divisions, each giving a drop of one volt for the normal current of the lamp. The value of the dead resistance depends on the size of the search-light, large lights requiring higher voltage across the arc than the smaller ones, and this value is such that with 125 volts on the dynamo side, the variable resistance will give at the search-light of from four volts below the best working voltage of the lamp to six volts above the best working voltage. Maximum allowable rise in rheostat is 75° C.

The feeders are of the following sizes:

13-in.	18,081 cm.
18-in.	30,856 cm.
24-in.	38,912 cm.
30-in.	60,088 cm.

Lighting circuits are divided into two classes, battle and lighting service, each class having separate feeders and separate mains.

The battle service includes every light installed below the protective deck and all lights above the protective deck whose use are necessary during action. This includes lights for operation of guns, at ammunition hoists, boat cranes, at controllers, in military tops, on search-light platforms, in conning tower, in signal tower, in limits, chart house, signal and running lights, compass light, lights at main blowers above the protective deck, and such light as may be necessary to allow access to compartments and passages during action.

The lighting service includes all lights not above enumerated. The maximum load on lighting feeders does not usually exceed 75 amperes. The area of cross-section of the feeders and mains is such that the fall of potential from the dynamo terminals to the most distant outlet is not more than 3 per cent. at the normal load of the feeder. No feeder or main has a cross-section that will give a greater current density than one ampere per 1,000 cm. All reductions in size of feeders or mains are fused and wherever mains are led off from feeders, it is done through standard feeder junction boxes, having double pole fuses, which blow on the basis of one ampere per 500 cm of the main. The branch outlets are fused for the normal rated load of three amperes and blow at six amperes. Fuses for feeders and mains are at the rate of one ampere per 1,000 cm and blow at one ampere per 500 cm.

Motors whose normal full load circuits are less than 50 amperes are grouped on one feeder, and this procedure is followed up to a total load of 100 amperes. Large motors with full working load exceeding 50 amperes are installed with a separate feeder. The area of the cross-section of the feeders for motors is such that the fall of potential from dynamo terminals to motor terminals does not exceed 5 per cent. at normal full load.

Mains from motor feeders pass through feeder junction boxes having double pole fuses. Where several mains lead from the same feeder at one point a distributing panel with double pole fuses is installed. All motor feeders and mains have a cross-section of not less than 1,000 cm per ampere for continuous service and 500 cm per ampere for intermittent service.

The wire in present use conforms to the following requirements: All conductors to be of soft annealed, pure copper wire. When greater conducting area than that of 14 B. & S. G. is required, the conductor shall be stranded in a series of 7, 19, 37, 61, 91 or 127 wires, as may be required; the strand consisting of one central wire, the remainder laid around it concentrically, each layer to be twisted in the opposite direction from the preceding, and all single wires forming the strand must be of the diameter given in the American wire gauge table

as adopted by the American Institute of Electrical Engineers, Oct., 1893.

The material and manufacture of the strand must be such that the measured conductivity of each single wire forming the strand shall not be less than 98 per cent. of that of pure copper of the same number of circular mils, the measured conductivity of the conductor as a whole to be not less than 95 per cent. of that of pure copper of the same number of circular mils. Each wire to be thoroughly and evenly tinned. All single lighting conductors shall be insulated as follows:

First.—A layer of pure Para rubber, not less than 1-64-in. in thickness, taped or rolled on; if taped, the tape to lap one-half of its width. Second.—A layer of vlucanized rubber about 3-32-in. thick. Third.—A layer of commercial cotton tape, lapped to about 1-32-in. in thickness. Fourth.—A close braid to be made of No. 20, 2-ply cotton thread, braided with three ends for all conductors under 60,000 cm, and of No. 16, 3-ply cotton thread, braided with four ends for all conductors of and above 60,000 cm. The outside diameter over the braid to be in exact conformity with that tabulated.

Motor applications on board ships involve the use of all sizes of motors from 1-12-hp to 50-hp. Fans for officers' quarters are of two sizes, 1-12-hp and 1-6-hp, the former for 12-in. desk or bracket fans, the latter for 16-in. bracket fans. Small ¼-hp series motors are used on portable ventilating sets. These sets are necessary for temporary ventilation when working in such parts of the ship as are not reached by the main ventilating system.

The main ventilating system employs motors of all sizes, from ¾-hp, used with small exhausters, up to 15-hp, which are used on the larger steel plate blowers. The controlling panels for these motors contain a double-pole line switch and a rheostatic starting-box with an automatic no-voltage and over-load release. A field rheostat for speed control is also mounted on the panel.

Ammunition hoists for 5-in. and 6-in., and smaller guns, are either endless chain hoists or whip hoists, and are operated by shunt-wound reversible motors. A motor of about 3-hp is used for the endless chain hoist and motors as large as 6 hp are used on the whip hoists. The chain hoist motors as a rule are located below the protective deck. They drive through gearing and are controlled by a panel similar to those described for the blower motors, and in addition by a double-pole, double-throw reversing switch. These motors are fitted with solenoid brakes, which release when the lever is moved to first notch and set up when the lever is thrown to off position. Motors for whip hoists when located in exposed places on the decks or bridges, are made water-tight by means of iron plates over the hand holes set up against sheet-rubber gaskets. They are fed from the line through branch blocks and switches enclosed in water-tight boxes. An enclosed cylindrical reversible controller is used.

For turret guns, chain hoists are also used, the motors being either suspended under the base of the turret or in the turret itself. These motors as a rule drive through a flexible cable, running over a drum on an intermediate shaft. Motors as large as 20-hp are required for 12-in. mounts, motors of about 16-hp for the 10-in mounts, and 8-hp motors for the 8-in. mounts. The first two run at 350 r. p. m., the last at 400 r. p. m. Each gun in a turret has its own ammunition hoist motor. The controllers are operated by a single handle, capable of sudden reversal, and carry the load in either direction without change of speed. Automatic circuit breakers are installed which break armature current only. The guns are elevated and depressed by shunt-wound motors of about 5-hp capacity, controlled in a manner similar to the ammunition hoist motors. For forcing the shell into the breech of the guns, rammer motors are used. These motors are series-wound, and drive through a friction sheave so adjusted that in case the shell is set home before the motor is stopped, the slipping of the driving mechanism will hold the motor load down low enough to prevent the throwing of the circuit breaker. These motors run at about 750 r. p. m., and are of 7-hp output for 12-in. mounts and 5-hp for 10-in. mounts. They carry the load in one direction only. Small motors are used to furnish air blast for clearing smoke out of the guns after firing.

Turrets are turned by motors operated on the Ward Leonard system, as at present installed, the use of a separate generating set being required for turning each turret. A system now under consideration embodies the use of a motor-generator for each turret, several of such motor-generators being supplied by one generating set. For 12-in. turrets, two 35-hp motors are installed, either one being capable of handling the turret alone. These motors, located diametrically opposite each other, drive a common cross-shaft through bevel gears, this shaft carrying near each end a separate worm, which actuates a pinion on a vertical shaft. The lower end of the vertical shaft carries a gear which meshes with an annular gear attached to the inner side of the barbette. The controller, located just under the sighting hood, is operated by one handle, and carries the load equally well in either direction. Automatic cut-outs are fitted at the limits of travel of the turrets.

Recent tests on turrets fitted as above show a nicety of control which is all that could be required. The turret was moved ten successive times, and only turned through an arc of 30.9 seconds. This would mean a single movement of 3.09 seconds, a distance scarcely discernible on the circumference of a 14-ft. circle (the outside of the turret). The turret was turned throughout its range of travel 136 degrees starboard to 136 degrees port, a total of 272 degrees in less than 45 seconds. The weight of the mass moved was about 600 tons.

Boat cranes, as at present installed, have but one motor for both hoisting load and revolving cranes, although on ships now under construction, separate motors will be used for each purpose. About 50 hp. will be used on the larger cranes for hoisting and lowering, and about 25 hp for revolving the crane. The control of the hoisting motor is by means of a resistance continuously across the line, the speed being controlled by the amount of this resistance with which the armature is placed in shunt. With this system, should the load on the crane tend to drive the armature at a speed in excess of that corresponding to the position of the controller handle, the armature will drive a current through the local circuit and run at constant speed until shut down.

In addition to the above-mentioned uses, motors are applied to drive air compressors for use in torpedo work, such compressors requiring about 25 hp, for closing water-tight doors; for lifting hatches; for dough mixers; for driving machine tools in the ships' workshops; for laundry work, etc. Electrically-operated steering gear and electrically-driven pumps are not used in our navy, although some foreign powers have applied the electric drive to such auxiliaries.

The means of interior communication consist of voice tubes, electric call-bells and annunciators, telephones, fire-alarms, general alarms, warning signal, engine telegraph, steering telegraph, helm indicator, revolution and direction indicator, battle and range-order indicators and transmitters. When a limited number of orders are to be transmitted, telegraphs are used; when an unlimited number of orders art to be transmitted and interior communication is necessary, telephones or voice pipes are installed, telephones being used for the longest leads. Between important stations, both telephones and voice pipes are installed. Call bells and buzzers are used without returns for minor purposes.

The fire-alarm system comprises an annunciator, near the captain's cabin (under the eye of the cabin orderly), and thermostats located in coal bunkers, magazines and storerooms near the same. When the temperature in these places rises above 200° F., the alarm is given at the annunciator and the location is indicated. The thermostat in present use consists essentially of a helix of metal ribbon (metal having a large expansive co-efficient) and a terminal block, with an adjustable contact screw. Its operation is based on torsional strain produced in the helix by a rise in temperature, thus completing the circuit through the contact screw in the terminal block.

There is a general alarm signal, which may be set into operation from a number of stations by electrical means. A solenoid whistle is employed to signal for closing water-tight doors. Electrical engine-telegraphs, located in the pilot house and conning tower, are only used to signal an increased or decreased number of revolutions, and are chiefly used in steaming in squadron, the range of signals being sufficient to preserve formation. The speed designated by the flag officer is telegraphed by means of the ordinary mechanical telegraph and small variations from the speed, by the electrical devices. The transmitter consists of a pedestal with a cylindrical case mounted thereon, containing the mechanism for ringing a magneto bell at the indicator station and making an electric light burn behind a figure on the dial of the indicator. Each of a number of lamps is in a separate compartment, so that it can illuminate only one of the perforated numbers. The indicator in the engine room is similar to the transmitter in all respects, with a magneto-bell placed above it.

Steering telegraphs are used to signal the desired degree of helm from the conning tower and the pilot house to all steering stations. Combined transmitters and indicators are located in the conning

tower and the pilot house. Indicators are placed in the communication room, hand-steering stations on the upper decks and steering engine rooms. These devices are exactly similar to the engine-telegraphs described above, except the orders on the dial.

Helm-angle indicators are installed at all steering stations, and indicate simultaneously the rudder angle at these stations. They are similar to the engine telegraphs, except the marking on the dials, and indicate angles of 0 deg., 2½ deg., 5 deg., 7½ deg., 10 deg., 15 deg., 25 deg. and 35 deg., with the center line of the ship.

Revolution and direction indicators are located in the pilot house and conning tower, one for each engine. The indicator consists of a circular water-tight case with glass face. The enamel dial is marked "ahead" and "astern" just over two small pointers. When the shaft revolves a vertical sliding motion is imparted to a rod which is raised and lowered three-quarters of an inch at each revolution. When the shaft is turning ahead, the connection between the end of the sliding rod and the section wire of the "ahead" magnet is alternately made and broken, and the indicators in the conning tower and pilot house will show a deflection of the pointer for each revolution. When the shaft is turning astern, the connection is made and broken between the rod and the section wire leading to the "astern" magnet in the indicator.

Battle and range order telegraphs and indicators are used to signal the orders to the battery, ammunition supply and the range. The principle of the battle-order and range-order instruments is that each order on the indicator is shown by a separate 5-cp lamp, controlled by a separate switch on the transmitter. The orders are marked on the counter by transparent plates on the face of the indicators, each plate having a lamp behind it in a separate compartment. The orders on the indicators are only shown when the lamp behind the order is made to burn by turning the switch of the transmitter. Any number of orders may be shown at the same time. The instruments are wired in parallel, and when a switch of the transmitter is turned, the corresponding order is shown on all the indicators. The orders signalled are, commence or cease firing, character of projectile to be employed, full or reduced charge, direction of the enemy and distance in yards.

The well-known Ardois signalling system is used to transmit rapidly and accurately under suitable conditions, a prearranged code of signals to a distant point, as from one vessel to another, or for squadron and fleet tactics, and for signals between vessels and cooperating commands on shore.

The search-lights have a vertical train of 70 degrees above horizontal and 30 degrees below. Parabolic mirrors are now used and are of highly polished glass, silvered on the back. The mirror is mounted in a separate metal frame, lined with non-conducting material in such a manner as to allow for expansion due to heat, and to prevent injury from concussion. The lamp is of the horizontal carbon type, designed for both hand and automatic control. It will burn for six hours without renewing carbons. The front of the drum contains a door of plain glass strips and a shutter for use in signalling. Until recently, the projectors were fitted with a system of electrical control for training the beam of light, but at present hand control is exclusively installed. The intensity of the beam of light is required to be such that on a clear, dark night a light-colored object, 10 x 20 ft. in size, will be plainly discernible at a distance of not less than 4,000 yards for the 18-in. projector, 5,000 yards for the 24-in. projector, and 6,000 yards for the 30-in. projector. The current required for operation with the voltage across the arc for the four standard sizes is:

13-inch,	18-20	amperes,	45-48	volts.	
18	"	30-35	"	47-50	"
24	"	40-50	"	48-52	"
30	"	70-80	"	49-53	"

Smeltzer carbons are used extensively and give good satisfaction, the positive carbon in the larger sizes being cored, with the negative carbon solid, and in some cases having a core smaller than that of the positive carbon.

The following are the standard incandescent lamps allowed: 16 cp, clear and frosted; 32 cp, clear, and 150 cp, clear, in the case of the diving lamp, besides instrument lamps for special purposes of 1 and 5 cp. The average efficiency of the 16-cp lamp is to be between 3.4 and 3.6 watts per candle-power; for the 32 cp between 3.4 and 3.8 watts per candle, and for the 150-cp diving lamp between 2.9 and 3.3 watts per candle-power. The life of an incandescent lamp is an important consideration in naval installation, as the ships are so frequently removed from a source of supply. It is proposed to specify 800 hours for the 16 cp, 500 hours for the 32 cp, and 300 hours for the 150-cp lamp as the average life, with the above efficiencies, the lamps not to have lost more than 20 per cent. of their rated candle-power while burning for these periods at the rated candle-power.

The Nernst Lamp.

At the Cincinnati Electric Light Convention the Nernst lamp was the subject of a topical discussion, partly through written communications and partly by discussion on the floor. A considerable portion of the remarks was contributed by central station men having experience with the lamp, and the discussion thus forms one of much practical interest.

Mr. F. H. Golding, of Branford, Conn., reported that the results thus far from the use by his company of the Nernst lamp have been very satisfactory. The customer is required to furnish the lamp and the station supplies renewals free of charge, as in the case of ordinary incandescent lamps. While he thinks the present price is rather high, yet, on the whole, he considers the lamp a commercial success. Mr. W. J. Greene, of Cedar Rapids, Ia., said 32 106-volt Nernst lamps placed in the office and dining-room of a hotel, have given splendid satisfaction so far as light is concerned. The life of the glowers, however, has been short, averaging less than 100 hours. A recording voltmeter shows an even regulation at proper e. m. f. Mr. Mordock, of Terre Haute, Ind., stated that his company had not gone into the Nernst lamp commercially, but have been burning one for 1100 hours. It was found that as the candle power falls off the current falls off. At the start the lamp consumed 170 watts, and has been burning about 1100 hours, consuming toward the end 140 watts. It is a 60-cycle, 208-volt lamp.

The Union Electric Light & Power Company, of Unionville, Conn., reported that it has installed 125 single-glower and 15 six-glower Nernst lamps on the street-lighting service, these lamps covering all the street lighting that this company does. From the standpoint of the public they are giving excellent satisfaction; the light is a pleasant one, and the fact that double candle power is given for practically the same price is of much satisfaction to the public. From the standpoint of the company, there as yet is not sufficient data to judge of their commercial success, as the lamps have been in use only about five months. It can be stated, however, that the company considers there is no question about the matter, provided a steady voltage is maintained, it having been found that any very serious variations in voltage affect the life of the lamp. The lamps have not yet been run 800 hours, but it is judged that the average life will attain that figure. While the lamps deteriorate somewhat, the deterioration is not so noticeable as it is in an ordinary incandescent lamp.

Mr. J. M. Uptegraff, of the Sewickley (Pa.) Electric Company, reported that his company is using Nernst lamps for street lighting, and is now installing the lamp for commercial and residence service, the customer buying the lamp and furnishing renewals. For street lighting the six-glower lamp is used and gives entire satisfaction. The lamps have been in use since October, 1901. The glowers have given an average life of 1,300 hours. The lamps are inspected but twice a week—Wednesdays and Saturdays—and all burned-out glowers are renewed on these days. The street lamps are furnished and renewed by the lighting company. Mr. J. H. Perkins, of Youngstown, O., did not consider the Nernst lamp in its present shape and at its present price a commercial success. The reason given is that the Nernst lamp has been successfully developed to meet the conditions and standards for but a very few central stations, and if adopted in its present form it would cost a great deal for change of system on the part of an electric-lighting company.

Mr. C. F. Nagle, of Savannah, Ga., reported that experience with the Nernst lamp had thus far been satisfactory to his company and to most of its customers. It was found necessary to use care in supplying glowers of the proper voltage for the current furnished, as excessive voltage will soon destroy the glowers. With normal voltage some glowers will burn out within 100 hours, but if they burn for 100 hours long life seems to be assured. It was found that business can be secured with the Nernst lamp that could not be obtained with either the arc or incandescent, and that it competes successfully with the Welsbach. The cost per kilowatt for supplying current for Nernst lamps is greater than for incandescents, on ac-

count of interest and depreciation in addition to cost of renewals and care of lamps, and it has therefore been found necessary to charge a higher rate per kilowatt-hour if the company furnishes the lamps.

In the oral discussion, Mr. S. T. Dunham, of Hartford, Conn., said that his company has had the Nernst lamp in use for 15 months, but principally for experimental purposes to determine its value. Not having any price for either glowers or lamps, it was not possible to determine the comparative economy of the lamp, but the conclusion has been arrived at that the Nernst lamp is closely related to the arc lamp in the matter of trimming. Every arc lamp is a new lamp every time you trim it; every Nernst lamp is a new lamp every time you trim it, and requires also about the same care in repairing and cleaning, principally cleaning. The question which occurs to everybody is, How often can you afford to trim the lamp, and what will it cost as compared with the arc lamp? As regards the relation of the Nernst lamp to the incandescent lamp, the same socket can be used. That the Nernst lamp gives quality of light cannot be questioned. The light is soft, brilliant, but not too bright, and as compared with the Edison lamp it is a superior light. As to the power question, you make a great saving in the installation of machinery and in all the various line systems and underground work, by putting in half the current. Mr. Dunham said he expects to install this coming year about five thousand Nernst lamps, which shows that he has confidence in them. It is a lamp of luxury, as the Edison lamp was within our recollection, when we paid seventy-five cents for a lamp, and which did not last very long, either; but the Nernst lamp will come within our reach as a bread-and-butter lamp more rapidly than the Edison, because it has severer competition. It must be put in such shape that it can be manufactured on a large scale, but you cannot reduce prices till you do manufacture on a large scale. The deterioration is less than with the Edison lamp. You get all the advantages of distribution in the Nernst lamp that you get in the Edison lamp, and which you cannot secure with the arc lamp. In conclusion Mr. Dunham said he considered that the lamp is certain to prove a success.

Mr. Frank S. Smith reported that the New York offices of his company had used for the purpose of general illumination, 48 single-glower, 3 three-glower and 6 six-glower Nernst lamps (a total of 93 glowers) on a circuit of nominal 216 volts, alternating current. Records show that at times the voltage has been as high as 242 and as low as 194, with an average variation of approximately eight per cent.; that is, four per cent. above and four per cent. below. The character of the light has been all that could be desired. Some little trouble was experienced in the cutout of the single-glower lamps shortly after installation. These were repaired, and since then have operated entirely satisfactorily. In the three-glower lamps a slight humming was noticed when first installed, but that was remedied and there has been no trouble since. Records of the number of glowers replaced were not kept previously to September 1st, 1901. From that date to April 18th, but 68 new glowers had been put in. In one instance, at least, in a single-glower lamp, there has been but one replacement during the year; this was in a lamp that has operated satisfactorily since the beginning, burning an average of four hours per day, with the glower now apparently in good condition. The care of the lamps has been intrusted to a boy about sixteen years old, whose duties have been to light the lamps in the morning and make replacements of burned-out glowers. It is interesting to note that apparently the best service is received from lamps with more than one glower.

As stated above, shortly after the lamps were installed, in May, 1901, some few mechanical defects were noted. It was not surprising that a few defects should be noted in these earlier lamps, as this might naturally be expected while the lamp was in a more or less experimental stage. These troubles have, however, been satisfactorily remedied, and the lamps have, without exception, operated perfectly satisfactorily ever since. As to what is claimed to be the high price of Nernst lamps this is natural in view of the presumably large expense involved in the experimentation necessary to bring the lamp to its present successful form. It would be natural to expect, now that the preliminary work is practically over, that the price of lamps will be reduced, so that there can be no reasonable ground for criticism on this score from now on. In conclusion Mr. Smith said that his experience with the Nernst lamp has been such as to demonstrate that in its present shape it is a commercial success. As to the extent to which the lamps are being used, he said that he had observed them in a great many places, and the replies to inquiries as to their successful operation have always been in the affirmative. The matter of renewals is a very simple one, which any intelligent office boy can successfully carry out.

Mr. E. F. Phillips of Detroit, Mich., contributed a lengthy written communication on the subject. His company, he said, had felt the necessity for some time for a lamp to fill the gap between the ordinary cluster and the 500-watt inclosed-arc lamp. In quite a number of places the cluster would not give sufficient light, while the 500-watt lamp would give more light than was really necessary; and in other cases, one arc lamp would not give sufficient light and two lamps, too much; besides, the cost of current to the customer in both cases would be more than circumstances would warrant. The 350-watt inclosed-arc lamp was tried, but with indifferent success, there being little difference in consumption of current between it and the 500-watt lamp, and also much less power of illumination. The Nernst lamp, therefore, appeared to them to meet the conditions above noted, and also to open a field for use of current which the company could not otherwise obtain. It would be a strong competitor of the Welsbach light and of the Humphrey gas arc. Another consideration was that it would serve as an educator in the use of electric lighting with but small expense to the customer. In one instance a Nernst lamp in a store was using Welsbach burners; after the lamp had been use a little over a month the customer wired his store for eleven inclosed-arc lamps and about 50 incandescent lamps, abandoning entirely the use of gas. In another case a Humphrey gas arc was displaced by a Nernst lamp to the complete satisfaction of the customer, both as to quality of light, and cost.

Following are some observations as to the renewals of glowers and general behavior of the few Nernst lamps Mr. Phillips' company has put in regular service:

Lamp No. 1: Three-glower, installed February 1st; March, all glowers changed on account of burning dim. Current consumed February 1st to April 23d, 117.2 kilowatt hours; cost to consumer, $7.55 net.

Lamp No. 2: Three-glower, installed January 29th. Current consumed January 29 to April 23d, 51.2 kilowatt-hours; cost to customer, $4.77 net. This lamp was burning well May 1st, with no change of glowers, and with apparently small decrease in illumination.

Lamp No. 3: Six-glower, installed January 6th, at a sub-station to burn all night, every night. This lamp was equipped with a small inclosing globe and shade. January 16th one glower burned out and globe badly blackened. January 23d, two glowers burned out. February 28th, put in new set of glowers. May 6th, one glower burned out. Current used January 6th to May 6th, 297.5 kilowatt-hours, with four glower renewals, or one glower to each 74.3 kilowatt hours, or 1486 50-watt lamp hours.

Lamp No. 4: Six glowers, installed March 4th. April 8th, one glower burned out. Current used March 4th to May 6th, 155 kilowatt-hours, or one glower for 77.5 kilowatt-hours, or 1550 50-watt hours.

Lamp No. 5: Three glowers installed February 25th. No renewals. Taken out, and customer installed eleven inclosed-arc lamps.

Lamp No. 6: Three glowers, installed February 26th. March 19th, one glower burned out. Current used February 26th to April 23d, 27.1 kilowatt-hours at cost to customer of $3.20 net. One glower for 540 50-watt lamp hours.

Lamp No. 7: Three glowers, installed March 21st. May 7th, one glower burned out. Current used, 26.5 kilowatt-hours, or one glower renewal for 530 50-watt lamp hours.

Mr. Phillips says he has not been advised as to the price the manufacturers intend charging for new glowers, but figuring on a basis in comparison with lamp renewals at half a cent per kilowatt-hour, in the cases noted, the cost for renewals would be as follows:

Lamp No. 1	117.2	kilowatt-hours	$.536	3	glowers.
" 2	51.2	" "	.256	0	"
" 3	297.5	" "	.487	4	"
" 4	155	" "	.775	2	"
" 6	27.1	" "	.135	1	"
" 7	26.5	" "	.132	1	"
Total	674.5	" "	$3.371	11	"

or an average of $0.306 per glower.

No record has been kept of inspection, or time consumed thereon, it being more the purpose to observe the working efficiency and adaptability of the lamp to commercial service than to obtain an elaborate

record of costs. The conditions observed were that there is a tendency on the part of the glowers to warp, thus bringing them so far away from the heater as to make the lamp very slow in starting up; the shortest time noted being thirty secouds and the longest three minutes.

There has been only one complaint of light becoming dim, and this was only proven when the old glowers and holder were substituted for new ones. It is not thought that this dimming is attributable to the black deposit on the holder, but is due to some defect in the glower itself, as new glowers have been put in partly blackened holders with appreciable difference in the light. Where warped glowers have been found, it has been possible to correct the lighting-up by turning them partly over, or bending up the terminals so as to bring the glowers closer to the heater. There has not been any trouble yet from the giving out of the steadying resistance, or heaters. In conclusion Mr. Phillips stated that to his mind, much the most important obstacle to be overcome is the prevention of the warping of the glowers, for on this depends the satisfactory operation of the lamp. First, because a glower that is warped will not light up quickly, and will consequently cause complaint from the customer. Second, tardy lighting throws the heater into action for a longer period and therefore necessitates its more frequent renewals. If this condition is remedied and no further defects are found in their operation—which, from the limited experience are not looked for—and the cost of glower renewals is not excessive. Mr. Phillips feels sure that, owing to the fact before noted—that there is a field for it—the lamp should come into quite general use.

At the conclusion of the reading of communications and the oral discussion, Mr. A. T. Wurts made a lengthy communication to the subject. Referring to the citation of a life of 1300 hours, he said that the frequency in this case was 125. As to the remark that if a glower survived 100 hours it would have a long life, it was explained that one of the chief causes of early breakage is mechanical strain on the glower. A glower expands and contracts particularly at times of lighting and turning off. The glower should be perfectly free and have an end play of about 1-16 of an inch, when no mechanical strain will be brought on the glower, and the average life, barring a defective glower or accident, should be 800 hours on sixty cycles. With reference to frequency, the life of the glower is 800 hours on 60-cycles, and 400 hours, apparently, on 25 cycles. There are experiments being carried on in Buffalo on the circuit from Niagara Falls, which indicate a considerable longer life than 400 hours, but these experiments have not been completed, and nothing definite can be said at this time. The figure of 400 hours is based on results obtained from about 350 six-glower lamps which are operated in the factory of the Westinghouse Company on 25 cycles. On 133 cycles the life seems to be about 1200 hours. As to the cost of trimming, there is as yet little data. The Westinghouse Machine Company has a large number of six-glower lamps in the factory and has kept a record of the labor required to take care of the lamps. The figures indicate that it requires a one-man-hour for 800 lamp-hours on the six-glower lamp.

As to the direct current lamp the Europeans have labored along the lines of a a direct current lamp, exclusively. They have not made the alternating current lamp, so that the direct current lamp is not only a possibility, but a fact. In this country it has been found that the life of the glower on the alternating current is much greater than with direct current. The Nernst lamp company, however, is now making direct current glowers and proposes to put them on the market very shortly—probably by the first of September. An interesting feature in connection with this subject is that all lamps will be exactly the same, whether for direct current or alternating current, except the glower. The direct current glower will be different from the alternating current glower, and the same remark applies to lamps for different voltages. As an illustration, the six-glower lamp for 220 volts is adjusted for 200, 230, 240, or whatever it is, and the lamps are the same in every respect except the glower.

As to the position which the lamp must occupy, so far lamps have only been made which will operate in a downward, vertical position. The reason for that is the cut-out, which operates by gravity. For any special cases the position of the cut-out could be reversed in the lamp, and in that case the lamp would operate in an upward vertical position; it has been considered, however, that the light should be thrown downward instead of upward and no steps have been taken to make a lamp which will operate in any other position than the downward. An endeavor has been made to produce a "universal lamp" which will operate in any position, but that will require something in the nature of a spring for a cut-out, and it has been found that a spring is not always reliable.

As to the useful life of the glowers, possibly that is a good deal a matter of opinion. The total life of the glower seems to be about 800 hours on 60 cycles. Whether that would be considered the useful life or not, must be determined by the user. Nevertheless, even at the end of 800 hours, the glower still has an efficiency which will compete with other lamps now in use. As to the range of voltage, there appears to be a misunderstanding with regard to the Nernst lamp being very sensitive to changes in voltage. This idea has arisen from the fact, very largely, that in every case the company asks for the accurate average voltage of the circuit upon which the lamp is to be operated, the object being that it could supply a lamp for the best possible satisfaction. In a great many cases where an incandescent lamp is bought and placed on the circuit, and not much attention given to the question of voltage, the life of the lamp is curtailed, but nothing is thought of this and the lamp is replaced; but the Nernst lamp, being new, the customer watches it critically to see whether it lives up to the claims made for it by the manufacturer. As a result, it is thought wise to request reasonably accurate figures with regard to voltage, so that the lamps can be adjusted at the factory for that particular voltage. A large correspondence, extending over six months has shown that very few central station people realize what a very great change there is in candle power for a very small change in the line voltage. There is a drop of forty per cent. in candle power in an incandescent lamp for a drop of five per cent. in voltage. That being the case, it is very important to have the correct voltage if the new lamp is to make a good impression.

The variation of candle power on the Nernst lamp, going upward, however, is exceedingly small, compared with the variation of the incandescent lamp. The variation in candle power for a five per cent. rise in voltage is only twelve per cent. in the Nernst lamp. The effect of an increased voltage on the Nernst lamp has been about as follows: Five per cent. rise for some hours does not seem to materially affect the life of the glower, but a five per cent. increase in voltage running continuously, would make a little difference in the life of the glower. A ten per cent. rise running continuously will blacken the ballast tube. A fifteen per cent. rise will make the ballast tube very black and a twenty per cent. rise will sufficiently heat the ballast tube to soften the containing glass bottle; thus by inspection of the lamp one is able to determine pretty closely how the lamp has been treated. But in the light of his experience with the lamp, Mr. Wurts feels it is impossible, on account of the very high corrective power in the ballast, to burn out a glower within 200 hours with a rise, say, of ten or fifteen per cent. The ballast goes first, but not unless the voltage is raised about fifteen per cent. and run continuously at that increase. Mr. Wurts said he is very confident that if a glower gives out in less than 200 hours, the breakage is due to mechanical strain.

In reply to a question, Mr. Wurts said the efficiency question is a difficult one to answer satisfactorily. He considers that the efficiency of the lamp should be based on its earning capacity. The lamps have been given merely a nominal rating. The one-glower is called a 50-candle power lamp, which figure was arrived at by measuring the candle power on the photometer bar in the direction of greatest intensity, and the one-glower lamp gives fifty candle power in this direction of greatest intensity with a clear glass globe. The company has, however, devised for itself a photometer. In its exhibition-room is a ceiling cluster of four one-glower lamps, with the sand-glass globes, and in four corners of the ceiling there are four clusters of three lamps each, of incandescent lamps, clear glass globes, making twelve- 16-candle power incandescent lamps altogether; it is the opinion of every one who has been in the room that there is a great deal more light, better illumination, from the four one-glower Nernst lamps than the twelve 16-candle power incandescent lamps. Most people say offhand that twice as much light is given out by the Nernst lamps, but a very conservative figure would be that the Nernst lamps are giving one-third more light. The four single-glower lamps take 352 watts. The candle power is measured by the twelve 16 candle-power units in the ceiling, all of which have reflectors over them. That is to say, the sixteen candle power incandescent lamps are taken as the standard, and with that data and the power supplied to the Nernst lamps, the efficiency of the Nernst lamp is estimated to approximate 1½ watts per candle.

The efficiency could be made a little higher or a little lower, according to the manner in which it might be considered. Taking the six-glower lamp, for instance, which is a large unit, in most cases it is desirable to throw the light down; it has been found that the mean spherical candle power of the six-glower lamp, from a thirty-degree zone, is one watt per candle, and from a sixty-degree zone about 1.23 watts per candle.

The National Bureau of Standards.

At the recent Cincinnati Electric Light Convention Dr. Frank A. Woolf, Jr., read a paper describing the plans of the new National Bureau, which paper we reprint below, in part, together with a view of the Bureau buildings as they will appear when completed.

A beautiful site of 7½ acres, in the northwestern suburbs of Washington, was procured within convenient access, but not too close to the car line to seriously interfere with any but the most precise measurements, which will, of course, constitute but a very small portion of the work to be undertaken. Moreover, this difficulty is easily surmountable by working after midnight when necessary.

The law appropriated $100,000 for a building, the cost of which was limited to $250,000. To meet the demands of manufacturing and technical interests for heavy testing work, and for experimental work requiring extraordinary facilities, a large and well equipped power plant is required, and this makes necessary the erection of a separate power house at some distance from the main building. The elaboration of the numerous details of construction of the two buildings occupied a great deal of time, and as the work progresses its scope broadened with it, so that when the preliminary estimates of the cost of erection of buildings of the necessary size had been made by the supervising architect of the Treasury, under whom the buildings are to be erected, it was found impossible to construct them for the sum specified. An additional appropriation of $75,000 was therefore asked for, and has just been granted.

The main building, as shown in the accompanying illustration, will be four stories in height, approximately 150 feet long, and 50 feet wide; and will contain about 50 rooms, all equipped with apparatus for verification work and for special investigations, and provided with gas, electric light, compressed air, suction, hot and cold water, as well as with a number of independent electric circuits, so that electrical currents of any desired character may be obtained.

The importance of temperature control in a physical laboratory has long been appreciated, and it is especially desirable in an institution where standardizing work is to be done, as nearly every result depends at least to some extent upon the temperature at which the measurements are made. Accordingly, means will be provided for closely regulating the temperature of any room at any desired temperature, both in summer and in winter, as will be more fully described below.

In most laboratories the basement, which, on general principles would really be most suitable for precise measurements requiring the greatest stability and freedom from vibration, has to be devoted to the heating, lighting, ventilating and power plant, and to miscellaneous purposes. As a special power house is here to be provided, the basement of the main building, which is almost level with the ground and well lighted, will be utilized solely for the more precise work. Four of the rooms are to be fitted up as special temperature rooms.

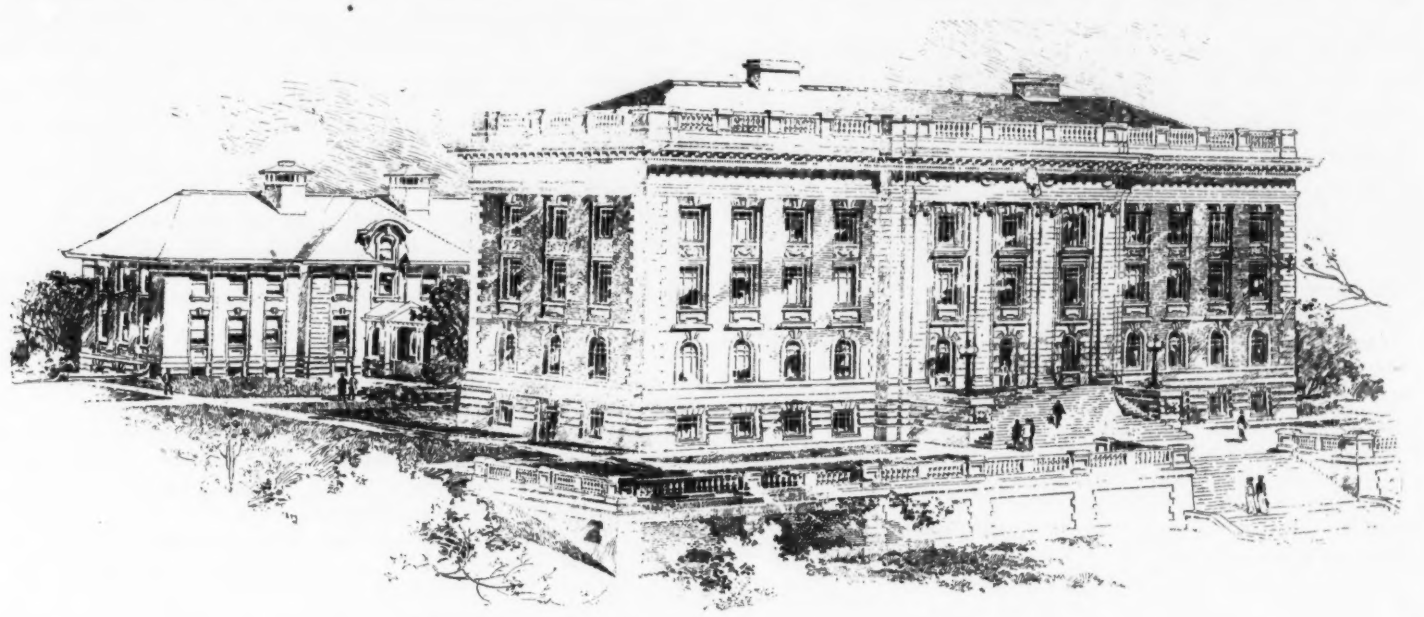
The basement will be vaulted over, so that the first floor rooms will be almost as free from vibration as those on the floor below, and will therefore also be utilized for laboratory purposes.

The second floor will be set aside for the administrative and clerical work, for the library, and for the museum, in which standards and apparatus of historical importance will be preserved.

A well equipped chemical laboratory will be fitted up on the third floor, part of which will accommodate a laboratory for photometric research. There will also be provided on this floor a lecture room with a seating capacity of 150-200. As it will be the policy of the Bureau to keep in close touch with the interests it serves, it is hoped that it may soon be in a position to extend invitations to scientific and technical associations to hold their meetings from time to time in Washington.

THE MECHANICAL LABORATORY.

The mechanical laboratory will be a three-story building, 135 feet long and 50 feet wide, and will contain the power and lighting plant, storage batteries, special alternating current machines for experimental and testing purposes, the refrigerating plant, the heating and ventilating plant, auxiliary apparatus, the machine shop and carpenter shop, as well as laboratories for heavy electrical testing, photometry, gas and water meter testing.



BUILDINGS OF THE NATIONAL BUREAU OF STANDARDS.

Boiler Room.—In the boiler room two 125-hp boilers are to be installed, space being provided for doubling this capacity.

Dynamo and Engine Room.—Two 80-hp high-speed engines, each direct-connected to two 25-kw. direct-current generators, will be installed. Additional space will be provided for a unit of double this size as well as for the special alternators referred to below.

The Heating and Ventilating Plant.—In the combined heating and ventilating system to be adopted, the air will be supplied to the various rooms by means of ducts, with the aid of electrically driven fans, the temperature of any room in either building being independently controllable by a thermostatic damper at the bottom of the respective flues, where the heated or artificially-cooled air will be mixed with the air from without. The ducts are so proportioned as to permit a complete renewal of air every fifteen minutes. In winter the air to be heated will be passed over coils fed with exhaust steam, and in summer the air will be cooled by coils through which cooled brine is circulated.

Refrigerating Plant.—To cool the air and to provide artificial ice,

a refrigerating plant of thirty tons ice melting capacity will be installed. Although the building will be used only a portion of the 24 hours, provision will be made for fully utilizing the refrigerating capacity, with the aid of a brine tank of sufficient capacity, the refrigerating machine being operated throughout the whole night when necessary.

Instrument Shop.—The instrument shop, a most important adjunct to a modern laboratory, will be equipped with the latest types of motor-driven precision and engine lathes, milling machines, shapers, drill presses, etc. The shop has not yet been organized, but three or four mechanicians are provided for from July 1, 1902.

A liquid air plant of sufficiently large capacity for all experimental purposes likely to arise, is also to be installed.

The auxiliary apparatus will consist of an exhaust fan for ventilating hoods, the storage battery room, the toilet rooms, etc.; air compressors, vacuum pumps, pumps for circulating the hot and cold water, etc.

As the public gas mains are not yet laid as far as the site, a gas plant will also be installed.

A storage battery room of considerable size is to be provided, and an adjoining room is to be fitted up for heavy current testing. Several of the rooms on the first floor will be used for experimental work, although no doubt as the work of the Bureau develops additional buildings will have to be provided, and the first of these will, in all likelihood, be an electrical laboratory. The mechanical laboratory will then be given up principally to power purposes and to the instrument shop. From present indications this contingency is likely to arise even before the buildings now planned are ready for occupation.

The third floor of the power house will, for the present, be devoted to gas and incandescent lamp photometry, and to gas and water meter testing.

The opinion has been expressed that the Bureau will not be ready to undertake verification work for some years, pending the construction and equipment of the buildings. Recognizing the importance of immediate work along a number of lines, temporary quarters have been secured in the Coast Survey Building, and arrangements are now being made to secure additional quarters nearby. In these apparatus will be installed and put in actual use as quickly as possible. Some of the work is already well under way.

One of the rooms has been fitted up for photometric purposes, and while the Bureau is not yet ready to verify incandescent lamps as photometric standards, the necessary apparatus has been delivered or is about to be delivered so that actual work can soon begin; and it is hoped that an announcement can be made within the next six months that photometric standards will be received for verification. Provision will be made for arc and Nernst lamp photometry, as well as for the photometry of Welsbach and acetylene lamps and other commercial types. The Bureau will exert its efforts to provide for a practical means of determining mean spherical candle power at the earliest opportunity. The question of photometric standards will also receive consideration, it being recognized that while the Hefner lamp is the best standard available, it is more than likely, judging from the researches at the Physikalisch-Technische Reichsanstalt, that a standard superior in every respect may soon be realized.

THE VERIFICATION OF ELECTRICAL STANDARDS AND MEASURING APPARATUS

Pending the construction of primary mercurial resistance standards, a number of 1-ohm manganin coils have been adopted by the Bureau as primary standards of reference. The values of these are *certainly* known to within .002 per cent., in terms of the primary mercurial standards of the Reichsanstalt, and errors due to variations are avoided by periodic reverifications at that institution. The construction of primary mercurial standards and secondary mercurial standards will very shortly be undertaken.

The manganin standards of the Bureau, which range from .0001 ohm to 100,000 ohms, have been subjected to repeated intercomparisons, the value of the multiples and sub-multiples of the units being determined in terms of the 1-ohm coils. The Bureau is thus equipped to undertake the verification of resistance standards, resistance boxes, potentiometers, ratio coils, volt boxes, and ammeter shunts, except for the present in cases where the resistance is to be determined when carrying large currents.

Facilities will shortly be provided for determining the specific conductivity of materials used for electrical conductors, and also for the determination of the tensile strength of such materials. Provision is also being made for the determination of insulation resistance, as well as dielectric strength and capacity of insulated wires and cables. The Bureau is prepared to receive for verification Clark and other types of standard cells, the values of which will be expressed in terms of the mean of about three dozen Clark cells which have been constructed at the Bureau.

The Bureau is also prepared for the verification of direct-current measuring apparatus of limited range, in limited quantity, millivoltmeters and voltmeters up to 150 volts, ammeters up to 100 amperes, and arrangements are being made for increasing the range to 2000 volts and 1000 amperes, when direct current wattmeters, watthourmeters, etc., will also receive attention.

Special facilities will be provided for alternating current testing. The alternators for experimental and testing purposes will all be driven by direct-current motors operated from the generators, or when necessary from independent storage batteries. Thus for investigating the influence of the higher harmonics on measuring instruments, condensers, transformers, arc lamps, etc., a set of motor-driven alternators, having relative frequencies of 1, 3, 5, 7, 9, 11, 13, and 15 times the base frequency, will be provided. All of these machines are to be connected to one shaft, and will be arranged so that the amplitude and phase of any component may be varied independently. The base frequency may be varied between 25 and 125; though for the latter frequency it will not be possible to work in the highest harmonics.

From this necessarily brief outline of the plans of the Bureau it will be seen that provision will be made for the verification of every type measuring apparatus which the electrical engineer is likely to submit, and it is hoped that as soon as the buildings are completed the Bureau will be in a position to undertake for the National Electric Light Association, and for similar bodies, the solution of important technical problems requiring extraordinary experimental facilities, and to co-operate with them in every possible way within its proper scope.

Grounded Secondaries.

A "Question Box" query at the recent Electric Light Convention as to the desirability of grounding secondaries brought forth a number of opinions. Mr. F. Elwood Smith, of Somerville, Mass., said that he believes that secondaries should be grounded, but does not know the best way to do it. Mr. R. G. Patterson, Waterville, Maine, believes it is impracticable, if not impossible, to maintain a ground sufficiently good to protect from accidents, and that even if that difficulty were overcome it would still be a question if the same expense could not be better applied in providing proper precautions to prevent accidents by so arranging that grounds could not be made by users with ordinary care. Grounding puts an unusual strain upon the transformer insulation, especially in lightning storms, and if it must be done, Mr. Patterson considers that the customers should do it and maintain the ground. His company has entirely abandoned the practice of grounding the secondary, owing to its unfavorable experience.

Mr. F. L. Sargeant considered it very important to ground the secondaries, as in the case of a cross between the primary and secondary lines it would prove a protection to the houses, and also in the case of a break-down between the primary and secondary windings. Mr. Jas. E. Pyle, Westchester, Pa., was opposed to grounding where overhead lines are used. He said his company had had several fires on account of the grounded system. When one wire becomes grounded there is a good chance to set fire to a roof if it is also grounded on a wire of different polarity, as when a service wire is pulled down by any cause, or becomes crossed with a telephone or telegraph wire that may be pulled across the main, or break and fall on a service wire. Another source of trouble with the grounded system is the burning of insulation joints. Mr. Pyle's company has had much trouble from joints giving out through fixture wires becoming grounded on the fixture, in which case the joint is sure to ground soon after. In conclusion he stated that he thinks it would be feasible to keep the entire system free from grounds.

Mr. W. J. Greene, of Cedar Rapids, Ia., favored grounding of secondaries, but awaited results from such practice before coming to a definite conclusion. Two secondaries grounded on his system several weeks before, but no trouble resulted; several storms have prevailed since in which a number of transformers, recently grounded

on one leg of the secondaries, were burned out. The writer of an anonymous communication said he had not availed himself of the right to ground circuits as permitted by the underwriters' rules, for he feared it would lead to carelessness on the part of employees. Should a house become grounded, instead of removing the ground, it would be a very natural thing simply to throw the ground on a leg of the secondary system. Aside from this fact, however, he believed that grounding is a wise precaution, and should be adopted.

Mr. P. Junkersfeld said that his company favors the grounding of the neutral on one leg of the secondary system, since this offers better protection to life and property. If one leg is properly grounded the maximum potential between any secondary wire and the ground is practically limited to the lamp voltage, since in the case of a breakdown between the primary and secondary there is a path to ground through the grounded secondary terminal. With an interconnected secondary system, electrostatic capacity might be troublesome and even dangerous, but it is entirely eliminated by grounding one terminal. In Chicago it is a comparatively easy matter to establish a good ground by burying a copper plate at the time the pole is set, or by driving a 1-in. gas pipe to a depth of, say, 6 to 8 feet.

Mr. H. H. Scott, of Lincoln, Neb., considered that if one of the three wires of a secondary system is to be grounded, it should be the neutral, for in this case it is only possible to get 110 volts on a 110-220-volt system in case of a breakdown causing accidental ground on either of the outside wires. Mr. F. L. Sargeant, of Malden, Mass., agreed in this, and also Mr. Jas. E. Pyle, of Westchester, Pa.

Developing a Power Service.

A number of opinions were presented before the Cincinnati Convention as to the best manner in which a central station power service may be developed. Mr. R. J. Patterson considered it to be a question of making the price right and letting people know it. He believed that the price should include an installation charge to make up for any loss due to the fact that the motor is only taking current part of the time. Mr. E. H. Mather, of Portland, Me., suggested an arrangements of the plant and distribution which will reduce the manufacturing and distribution cost to a minimum, and to present the advantages of electric power to the public through capable solicitors.

Mr. Chas. H. Peters, of Durango, Colo., suggested selling motors on a small margin of profit, and in case where a customer using steam is thinking of making a change in power, to offer to take a few indicator cards under varying loads, from which to calculate the average horse-power, and then to give the customer an idea of what the power will cost him, approximately; otherwise a rate based merely on kw-hours will not be understood.

An anonymous communication expressed the opinion that the best results will be obtained by employing a competent engineer to encourage power business, and to apply individual methods to each power consumer. The great difficulty in the way of obtaining power consumers is that they always believe power is costing them less than it really is, and that they think they are using more power than they really are. The total power is best obtained by indicating the engine, and the transmission losses are measured by running certain groups of machinery idle some day when the factory is not in operation.

Mr. John Gilchrist, of the Chicago Edison Company, suggested putting in the field as exclusive power solicitors, men who have had some experience in the installation and running of machinery, who will present in detail to the users of power the advantages of electrical machinery. It should be made easy for a man to install the service, either by selling him the motors at cost, or enabling him to buy them upon a time basis of one or two years, with a very small interest charge. It should be assumed that no good business man is going to take up a new thing at a considerable expense unless the concern which is selling it is sufficiently anxious to get the business to do the walking and talking, and is willing to bear at least in part, if not all, the chances of its being unsatisfactory.

Mr. P. G. Gossler, of Montreal, suggested that preliminary to a contract, a customer should be induced to ascertain as nearly as possible what his power under present conditions is costing him. The customer should be favored who will have a high average demand; the rates for the customer who has a very variable load and a very high maximum, and low average demand, would necessarily be higher, but should still be below the cost of power supplied from an isolated plant. A reasonable reduction in rates should be made as the quantity increases, in order to encourage large power users to employ electric power. The basis of measurement should be the volt-ampere and not the watt. There should be several bases for charging, and equivalent rates should be quoted in several ways so that the customer may select the one which he thinks suits his particular case the best. A limited service field should be cultivated as much as possible by offering good discounts to customers who are willing to shut down their motors in whole or in part during the time of peak lighting load. In case of fixed and meter rates, the discount should be taken from the fixed rate, as this would be more attractive to the customer. Power users will be apt to be skeptical as to the feasibility of limited service, but if proper discounts are allowed, many will be found who can take power under this class of contract to the advantage of both customer and station.

Niagara Power for Toronto.

It has been determined that the transmission of the energy of Niagara to Toronto, Ont., is to be accomplished at a voltage of 60,000. For some little time experiments have been in progress at Niagara Falls, N. Y., where a line on which 60,000 volts were carried has been experimented with, the result being that it is announced that this voltage will be applied to the transmission line about 90 miles long, extending from the Canadian side at Niagara to the city of Toronto. In the plant of the Canadian Niagara Power Company the power will be developed at a voltage of 11,000, and in units of 10,000 hp. Details of this have already been given in ELECTRICAL WORLD AND ENGINEER. A contract has been awarded to the Canadian General Electric Company for 12 transformers, to be used in stepping-up the voltage from 11,000 to 60,000. The amount of power to be transmitted to Toronto at the start will be 10,000 hp, the entire product of one of the generators.

While it has not been stated what kind of cables are to be used on the transmission line, the indications are that aluminum will be the metal favored. It will be recalled that the last transmission system installed between Niagara Falls and Buffalo by the Niagara Falls Power Company uses aluminum cables. These have been giving good service, and when it is considered that the use of aluminum will aid in effecting quite a saving in the pole line construction for the distance of 90 miles, there is some reason why the white metal should be used.

Work on the tunnel and wheel-pit of the Canadian Niagara Power Company is moving along at good speed. Over 1,000 feet of the tunnel has been driven, and the pit is being sunk at a satisfactory speed. While the Canadian Niagara Power Company will be the generating company, it is not certain whether it will undertake the Toronto transmission, or whether it will dispose of its current product at the station to another company, which will transmit it to Toronto. At the last session of the Dominion parliament the Toronto and Niagara Power Company was incorporated. So far, little is known of this latter company, but it may be its purpose to participate in the transmission of Niagara power to Toronto.

Toronto has been an eager applicant for the power service of Niagara, and for all the power the Canadian Niagara Power Company may have developed the latter half of next year; there will, perhaps, be little need of Toronto waiting until that time, providing the transmission line shall be completed before then, for the installation of the new wheel-pit and station of the Niagara Falls Power Company, at Niagara Falls, N. Y., will, it is expected, be supplying power this coming fall, and could spare 10,000 for the Toronto transmission if it was desired. In this connection, it is interesting to note that at a meeting of the directors of the Canadian Niagara Power Company held in Toronto Saturday, June 7, W. H. Beatty was re-elected president; William B. Rankine, vice-president and treasurer, and A. Monro Grier, secretary. The executive board is composed of the president, vice-president and Wallace Nesbitt.

Coronation Telephones.

A cable dispatch from London states that all the houses that are being loaned to or hired by the King for coronation guests are being connected with Buckingham Palace by telephone, for convenience in making appointments and ordering carriages.

New Telephone Patents.

To telephony the issue of June 3 contributes five patents, none quite without interest, but none of prime importance to the art. The range of subjects is sufficiently wide, as intercommunicating systems, party-line calls and automatic switches are all represented, and a novel indicator and a new method of telephoning round out the list. An intercommunicating switch, the joint invention of Nathan Bassett, of Philadelphia, and William S. Phoenix, of Camden, N. J., has several ingenious features. The switch contacts are made by means of U-shaped springs attached to plugs 22, sliding in disk 18, the top of the plug 23 projecting above the cover of the base of the instrument. As shown in the detail sketches of Fig. 1, the spring contact-maker is a continuous piece, and the plug may be of metal; in this case the depression of the plug, by spreading the ends 25 of the U-shaped spring 24, brings them in contact with posts 26, so completing the circuit. This is for a common return system; with metallic circuits the form shown in the lower sketches is used, the plug being of insulating material and carrying two springs insulated from

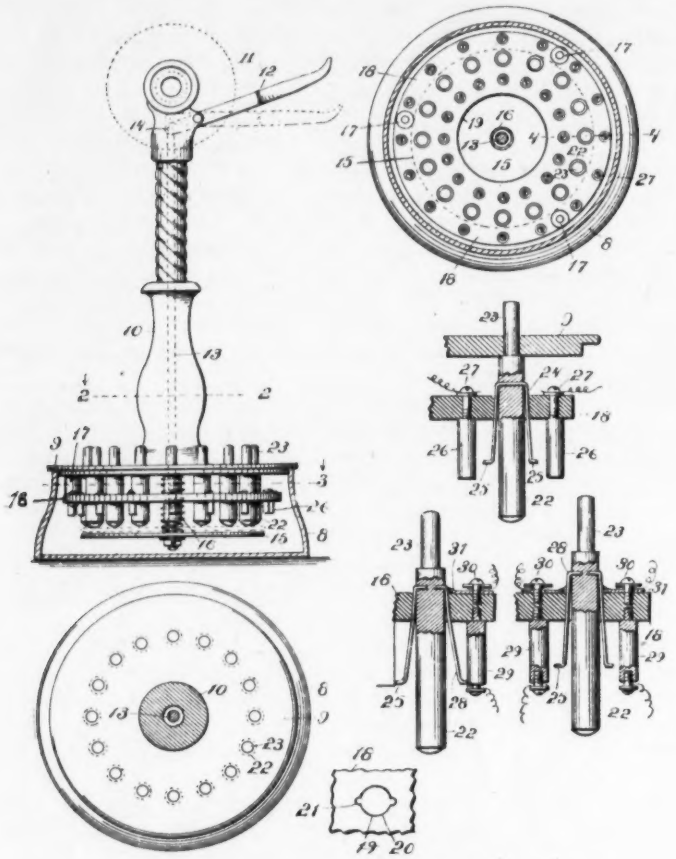


FIG. 1.—INTERCOMMUNICATING TELEPHONE SWITCH.

each other; the springs make rubbing contact with plates 31, held under screws 30, to each of which one wire of the circuit is attached, the other two wires being connected to posts 29, insulated from screws 30 by the disk 18 of insulating material. The depression of the plug by bringing the springs in contact with posts 29 completes the circuit between 29 and 30 on each side. The plugs are set circularly in a disk, 18, of insulating material, each plug-hole, 20, having gains, 21, in which the springs slide. When the receiver is on the hook all the plugs are automatically locked out of action by the disk 15, attached to bar 13, which passes through the center of the stand and is pivoted to the switch-hook 12 at 14. When the receiver is on, the hook 15 is raised and prevents the operation of any of the plugs.

Mr. Joseph B. Baker makes a highly ingenious application of the properties of translucent material in a signal or indicator, in which the target is moved too and fro behind a translucent screen. The invention is based on the fact that an object placed immediately behind a translucent screen, such as a piece of ground glass, is plainly visible through the ground glass, but becomes invisible on being moved a very short distance away. Mr. Baker embodies this principle in a signal, "the details of construction of which may vary almost indefinitely, but which all have the generic combination in common in which my invention, broadly stated, consists—namely, a translucent body and a movable signal emblem or device moving toward and from it from behind.

"In the posterior position the signal emblem or device may be rendered entirely invisible, if desired, by removing it to a sufficient distance from the translucent body. In the anterior position the signal may be rendered about as clearly visible as if the translucent material were removed by having the emblem contact with the translucent material, or, if a lesser degree of visibility suffices, the signal emblem in its anterior position is made to lie near to without touching the translucent substance. The translucent body may naturally be made of a variety of materials. I have found ground glass to answer excellently."

Mr. Baker further points out that glass coated with a preparation to make it semi-opaque, glass covered with tissue-paper, celluloid with or without glass, are examples of translucent materials that may be employed. The movable signal may be of a variety of shapes and colors, a black or white disk plain, lettered, numbered or marked with a special device. In all cases the movable emblem is nearly or quite invisible through the translucent material in its posterior position, and it becomes plainly visible in its anterior position.

All this being set forth, a description of the embodiment of the

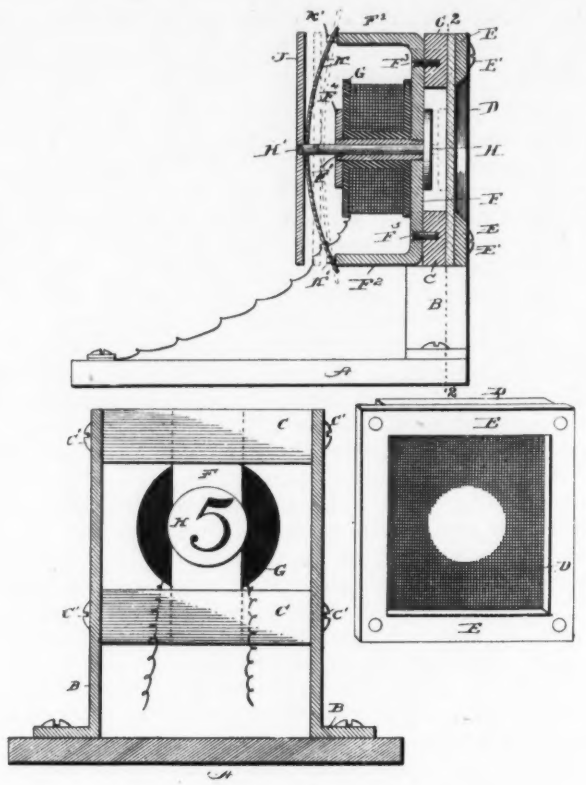


FIG. 2.—BAKER SIGNAL.

invention shown in the drawings is hardly necessary. Referring to Fig. 2, *D* is the translucent screen and *H* the target carried on the rod *H'* of non-magnetic metal projecting from the armature *J* through the core of the magnet. The armature is retracted, holding the target in the invisible position by the blade spring *K*. When the magnet is energized the target is moved forward against the screen, as shown by the dotted lines. A lower figure shows the screen masked by opaque paint except for a circular area the size of the target; this renders the target less visible when retracted, and heightens the contrast when the target is moved forward.

Mr. Nils Emel Norstrom, of Chicago, patents for automatic exchange purposes an arrangement of relays similar to that described in a previous application filed March 31, 1900, but differing in details of construction. The principle is an automatic switch for each telephone, the operating magnets of the switch being controlled by a relay operated by the telephone station. The drawings (Fig. 3) show a side elevation of the relay and connected mechanism together with connection to a battery and one magnet of an automatic switch; a front elevation of the same and a diagram of connections of a series of telephones and relays. The bars *N* and *S* of soft iron are polarized by the permanent magnets *M*. The brackets S^1 on the south bar, *S*, carry the relay magnets *R* R^1, and the pivot blocks N^2 on the north

bar, N, carry the armatures N^1, which, when attracted, close the circuit of connecting switch, A, as clearly shown in the middle figure. There are two moving magnets, A and B, for each switch, as shown in the lower figure, only one, A, being shown above. From each telephone station having battery, Y, a wire, 10, runs to relay R, and is branched by 11 to R^1, and wire 13 runs to R^1 and is branched by 12 to R, so that current sent over either line divides between both coils, the coils being so connected that current, say on line 10, causes the

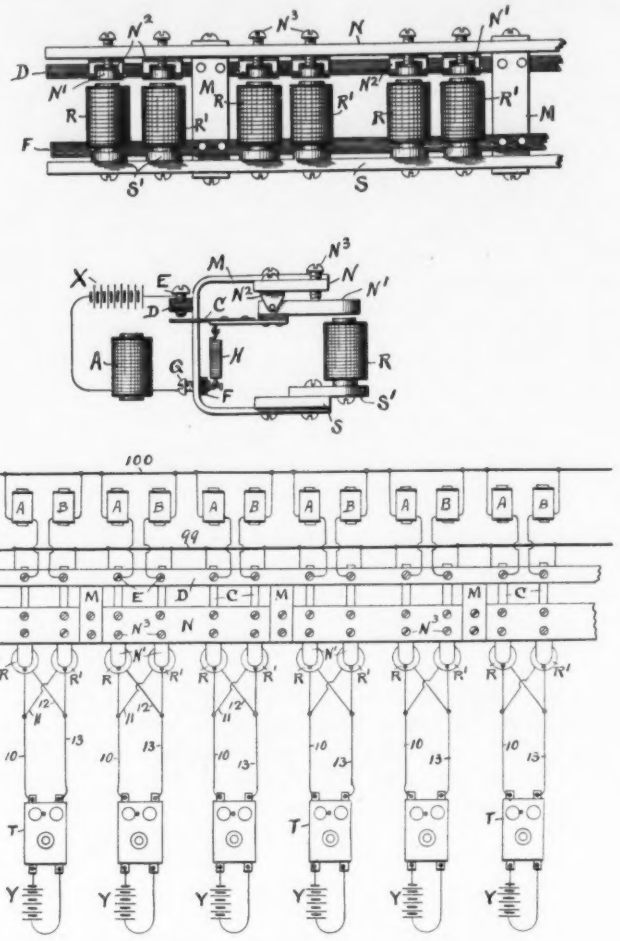


FIG. 3.—NORSTROM'S AUTOMATIC EXCHANGE RELAYS.

upper end of one magnet to be of north polarity and of the other to be of south polarity. The armatures N^1 polarized by N are all of the same polarity, and when R is made south and R^1 north, the armature of R will be attracted and that of R^1 will not. The attraction of the armature of R closes the circuit of magnet A. A reversal of the conditions, caused by sending current on line 13, will cause the armature of R^1 to be attracted, that of R remaining inert, and close the circuit of switch B.

Recent Progress in Electrochemistry.

By Clinton Paul Townsend.

A novel method for the production of calcium carbide is suggested by MM. Vulitch and d'Orlowsky, of Paris, the authors proposing as an alternative to the usual practice of heating a suitable mixture of lime with carbon, to first fuse the lime in an arc furnace, and then discharge the molten mass into an excess of heavy hydrocarbon, such as "masud," or other residue of petroleum distillation. The formation of the carbide occurs within the body of the hydrocarbon and the product possesses, as would be expected, some distinctive properties, it is loose and non-coherent, and is saturated throughout its mass with the hydrocarbon, which modifies its relations with water, rendering it practically non-hygroscopic. It is peculiarly adapted for the intermittent generation of acetylene, since it is not penetrable by water and the evolution of gas continues only during the period of actual immersion. It is asserted also that it is free from phosphorus, which is eliminated by forming with the hydrocarbon volatile hydrides.

METALLIC PAINT.

Hall's improvements in electric furnace methods for the purification of bauxite were described in the Electrical World and Engineer, issue of July 6, 1901; as will be recalled, the silicon and titanium are separated by reduction, and are collected in iron, either normally present or added in proper quantity. An additional patent issued to Hall, under date of June 3, 1902, deals with the utilization of this alloy as a basis for a metallic paint. An alloy containing about 60 per cent. of iron and 40 per cent. of one or all of the electropositive metals mentioned, is brittle and readily comminuted; mixed or ground with oil it constitutes the paint of the patent.

COLLOIDAL METALS.

The colloidal condition assumed by many metals under special conditions of precipitation is clearly a problem for the electrochemist, and when fully elucidated will undoubtedly throw additional light upon the mechanics of solution. Such metals as gold, silver, platinum, tin and mercury, may be readily obtained in a form soluble in water, but separated therefrom by evaporation, freezing, or the addition of electrolytes. Subjected to the electric current they separate upon the anode, or if a diphragm be employed, upon its negative side. In common with other colloids they are incapable of penetrating a porous membrane, and their solutions may therefore be concentrated by dialysis.

Colloidal silver is well known through the classic work of Carey Lea; colloidal gold has been studied by Zsigmondy, who prepared it by the reducing action of aldehydes upon extremely dilute hot alkaline solutions of chlorid of gold; and colloidal mercury has been prepared by Lottermoser by reduction by stannous chloride. Gold, silver, platinum, cadmium and zinc have also been obtained in this form by Bredig by the action of a luminous arc between metal wires in an extremely dilute solution of caustic potash. Dr. Carl Paal, of the University of Erlangen, has now prepared both gold and silver not only as colloidal solutions, but as measurably pure metallic products. The gold exists as bright scales of bronzy luster containing over 70 per cent. of the metal, and the silver as lustrous blue scales of above 90 per cent. purity. Both metals readily and completely dissolve in water, the silver with a bright yellow-brown coloration and the gold to the intense red solution of Zsigmondy. Both metals are precipitated by dilute acids, but in sharp contradistinction to the forms heretofore obtained, the precipitates readily dissolve again in weak alkali.

The colloidal gold is prepared by pouring the chloride in concentrated aqueous solution into a heated alkaline solution formed by the treatment of albumins with warm dilute alkali; the solution obtained is dialyzed against water, precipitated by dilute acetic acid, redissolved in dilute caustic soda, and the metal recovered by slow evaporation. Colloidal silver is prepared in a substantially similar manner.

Marconi Station at Cape Cod.

It is stated that the new Marconi station at Cape Cod will be ready at the end of this month. The station is on a bluff, about 100 feet above sea level, and is nearly 2,900 miles from Poldhu, in Cornwall, from which point communication with Newfoundland was effected last December. Four square wooden towers have been erected at this point. Each measures 28 feet across at the base, is from 9 to 11 feet across at the top, and attains a height of 215 feet from the earth. The towers stand at the corners of a square, whose sides are 210 feet long. Each one is cross-braced with steel wire rope, such as is used in rigging a yacht. Then all four are connected with each other by diagonal stays. Finally, to render the structure still more rigid and windproof, stout cables are run up over the tops of each pair of towers on all sides, and secured to anchorages in the earth. So much for the architectural features of the station.

From each of the four horizontal bridges which connect the tops of the towers are suspended 50 copper cables. The cables are composed of seven strands, one-eighth of an inch in diameter, tightly twisted together. Outwardly these cables look like single wires at a short distance, but in reality there are 350 wires on a side, or 1,400 in all. Perhaps the reason for using many fine strands instead of

a few large rods is to secure a larger amount of surface for a given amount of copper. It will thus be seen that the solitary "vertical wire" of the orignal Marconi experiments has now been enormously multiplied. Since the length of a Hertz wave is four times the length of the vertical wire, or antenna, waves not far from 860 feet (or one-sixth of a mile) long should be developed at the Cape Cod station. This corresponds to a frequency of about 1,100,000 a second. The 50 cables of each of the four groups converge a little as they go downward, and also incline slightly toward the center of the quadruplex edifice. The lower ends, therefore, are arranged along the sides of a square much smaller than that formed by their supports at the top. It is expected that Mr. Marconi will retain the coherer as his receiving instrument at South Wellfleet.

In the transmitting apparatus transformers will be substituted for the old-fashioned induction coil. The spark-gap will be scarcely more than an inch long, but the spark itself will be widened, or thickened greatly by the shortness of the interval. It will be produced between globular terminals, two inches in diameter. An alternating current, generated by a 40-hp dynamo, will do the work. The voltage will be raised by the transformers from 2,000, at which the current is to be generated, to 20,000. Condensers and other electrical appliances will increase this still further. Thus a voltage of from 50,000 to 70,000 will be secured. The dynamo will be driven by two 22-hp gasolene engines, run in combination.

CURRENT NEWS AND NOTES.

TIMELY TOPICS.—At the recent Electric Light Convention a vote was taken to ascertain opinion as to relative interest taken in the principal subjects discussed at the meetings. The vote stood as follows: Rates, 27; hot water vs. steam-heating, 13; free lamp renewals, 5; improvements in meters, 5; gas engines, 3.

CANADIAN ELECTRICAL ASSOCIATION.—The Association began its meeting this week at the Chateau Frontenac, Quebec, where 82 members had already registered on Tuesday. The halls and parlors have been specially decorated with garlands of the Elblight cable, holding 2,000 lamps, while a mile of the cable has been festooned along the ramparts with 4,000 lamps in red, white and blue.

MARINE ENGINEERING CONGRESS.—The proceedings of the International Navigation Congress, which will be held in Dusseldorf, Germany, from June 29 to July 5, will be printed in German, French and English for distribution to those who subscribe as members of the Congress. About 100 papers will be presented for discussion. Applications for membership will be received up to the date of the Congress by the Secretary, 80 Wilhelmstrasse, Berlin, W., Germany.

LIGHTNING AND SYNCHRONOUS APPARATUS.—In answer to a query sent out by the National Electric Light Association, as to what effect lightning will have on synchronous apparatus operated from transmission lines. Mr. C. E. Burrows, of Walla Walla, Wash., communicated the answer that with single-phase apparatus, lightning always causes step to be broken, and generally burns out one or more coils of the generator. As a consequence of this, his company has discarded single-phase synchronous apparatus.

TELEGRAPHERS' WAGES.—It is stated that Western Union employes are much disturbed over the wholesale reductions in salaries which are now being made. It is said to be the ambition of the management to increase the profits of the company $2,000,000 a year. It is also noted that reports of a growing uneasiness among the company's operators have been published in some of the daily papers, but Superintendent Brooks states that there is no real cause for it. The shifting of men from the regular force to the waiting list, and other changes of similar nature, are looked upon by the men with disfavor. It is reported that the telegraphers are organizing a union for protective purposes. New York Central Railroad will advance the wages of 2000 signalmen, telegraphers and towermen.

WIRELESS TELEGRAPH PLANTS.—The Marconi Wireless Telegraph Company has completed its new station at Sagaponack, near Bridgehampton, L. I. This will supplement the Nantucket Station's work in furnishing maritime information. The American Line has signified its intention of installing the Marconi system now used on the Philadelphia, on board the St. Louis and the St. Paul. The United States Coast Survey has made arrangements to use the device on board of one of its steamers, and the United States Signal Corps has signed a contract for its employment in Alaska. The towers at Cape Breton, it is reported, have been completed.

DANGER TO CABLE STEAMER.—It will be remembered that the cable steamer "Grappler" was destroyed by the volcanic eruption at Martinique. A dispatch of June 10 from St. Thomas, W. I., says: In the course of the eruption of Mont Pelee, on the Island of Martinique, which occurred June 6, the sea rose about twenty-eight inches at Fort de France and then fell again. The rise of water did not cause any damage. The French cable repair ship "Pouyer-Quertier" was directly opposite the lower crater of the mountain on June 6 grappling for a cable five miles off shore when dense black clouds shot down from the volcano in the direction of the sea. This phenomenon was similar to that of May 8, but the clouds moved in another direction. The "Pouyer-Quertier" fled from the spot at full speed, and the clouds followed the steamer about one mile astern. The vessel's decks were covered deep with ashes, mud, and stones, which rained from a huge cloud that had shot up to a great height from the top of the crater.

INDEPENDENT TELEPHONE CONVENTION.—With regard to the Philadelphia convention of the Independent Telephone Association of the U. S. A., to be held June 24, 25, and 26, we may now add that the headquarters will be at the Hotel Walton. A circular has been issued by President Thomas and Secretary Sheerin inviting attendance. The local Philadelphia committee is S. E. Wayland, R. H. Foederer and C. E. Wilson. Inquiries, names of delegates, etc., should be addressed to Mr. Wayland. The Keystone Telephone Company and other organizations will extend courtesies of various kinds. The convention will be called together at 10 o'clock Tuesday morning, and the sessions will be held in the Palm Roof Garden of the Hotel Walton. Tuesday afternoon will be devoted to sightseeing about the city. Business session will be held Wednesday morning, followed by a tallyho ride up the Wissahickon. Wednesday afternoon. Thursday morning another business session of the convention will be held for the election of officers, etc., and at the close of the convention an excursion will be given to Atlantic City.

A. A. A. S.—The Finance Committee of the coming convention of the American Association for the Advancement of Science has already raised $7,500 toward the expense of the meeting. The largest contributor is Mr. George Westinghouse, who cables from abroad a subscription for $1000. Mr. H. C. Frick and the Carnegie Steel Company each contributed $500. It is expected that the attendance at the meeting will exceed 1000, and every arrangement is being made for the proper reception and entertainment of the visitors. Of the 23 papers to be presented in Section B (Physics) at the Pittsburg meeting of the American Association for the Advancement of Science, no less than 14 are on electrical and magnetic subjects, as follows: "Contributions to the Theory of Concentration Cells," by Prof. H. S. Carhart; "The Oscillatory Charcter of Lightning," by Prof. A. W. Muth; "On the Complex Product of e. m. f., Current and Other Vectors," by Prof. H. T. Eddy; "Direct-Curent Dynamos Arranged in Series for High-Tension Work," by Prof. G. S. Moler; "Results of Recent Magnetic Observations," by L. A. Bauer; "Some Recent Magnetic Disturbances," by L. A. Bauer; "Theory of the Electrolytic Rectifier," by Prof. K. E. Guthe; "Rayleigh's Alternate Current Phasemeter," by Prof. E. S. Johonnott; "Efficiency of the Mercury Arc Lamp," by W. C. Geer; "A New Form of Laboratory Switchboard Jack," by Prof. F. C. Coldwell; "A New Variable Inductance Coil," by Prof. F. C. Coldwell; "Effect of Electrolytic Condensers in Alternater Current Circuits," by A. Trowbridge and E. R. Wolcott; "Emission of a Righi Vibrator and the Measurement of the Length of Electric Waves," by H. R. Willard and L. E. Woodman; "Radiometric Receiver for Electric Waves," by G. F. Hull.

THE PENNSYLVANIA RAILROAD'S TELEGRAPH SYSTEM.—It is reported from Philadelphia that negotiations are in progress between the Pennsylvania Railroad and the Postal Telegraph Company concerning the operation of the railroad telegraph system. As noted in these pages, May 24 last, the existing contract between the railroad company and the Western Union Telegraph Company, which is now operating on the railroad company's right of way, will expire six months hence and the Pennsylvania Company has given the Western Union Company notice that it will not renew the contract.

ELECTRIC ROAD FOR SPAIN.—Mr. Julius G. Lay, U. S. Consul-General at Barcelona, Spain, writes: A royal decree of March 7th grants a concession to Don Teodoro de Mas y Nadal to construct, within the next six years, an electric railway between the towns of Vich and Amer, in the province of Gerona. The capital of about $1,200,000, which is estimated as necessary to build this railway, has not yet been subscribed; but if Señor Mas is as successful in securing capital from foreign countries as other promoters of electric railways have been, it will only be a short time before the road is in operation. I send a memorandum of this project, showing in detail the estimated cost of construction, material required, water power available, cost of maintenance, receipts, etc.

ELECTRICITY FROM AIR.—The London *Daily Mail* hears from its Las Palmas, Canary Islands, correspondent that Señor Clemente Figueras, of that place, has discovered a method of "directly using atmospheric electricity without chemicals or dynamos and practically applying it without any motive force." Señor Figueras is jealously guarding his invention and is not disposed to say anything more about it just now than "that the only extraordinary point about it is that it has taken so long to discover a simple scientific fact." The inventor, who is professor of physics at St. Augustin's College, Las Palmas, will, according to a despatch to a New York paper, soon go to Madrid and Berlin to patent his invention. It is stated in the original communication that Prof. Figueras "has constructed a rough apparatus by which he obtains a current of 550 volts, which he utilizes in lighting his house and driving a 20-hp motor." As usual in such cases, "the whole apparatus is so simple that a child can work it."

CIRCUIT VOLTAGE REGULATION.—In reply to a "Question Box" query at the Cincinnati Convention as to what degree of accuracy in regulation should be required in each part of the distributing system between the station switchboard and the consumers' meters, it was stated in an anonymous communication that in an alternating-current plant it is possible and practicable to maintain regulation within 2 per cent., and the writer considered that this should be the maximum limit allowed. In a direct-current plant it is possible but not practicable, to maintain regulation within these narrow limits, and 2 per cent. regulation in such plants was pronounced a myth in spite of the statements of the engineers of direct-current stations. The writer said that in the latest case of a 2 per cent. station which he investigated, he found that the regulation was about four times this in actual results. By a 2 per cent. regulation he understood that the pressure at any point in the system should not vary more than 2 per cent from the maximum voltage.

TRANSFORMER BREAK-DOWN TESTS.—Among the queries in the "Question Box" considered at the recent Electric Light Convention, was one asking for information as to what break-down tests should be demanded of manufacturers of transformers for 2000 to 2500-volt distribution, where secondaries are to be grounded. Mr. E. H. Jenkins, of San Antonio, Tex., considered that 10,000 volts alternating should be enough between primary and secondary coils, between coils and core and coils and case. Mr. R. S. Kelch, of Montreal, said that when the standard insulation of 2½ times the working pressure is required, the transformer is a better lightning arrester than the instruments generally used for that purpose. For the past two years his company has bought transformers with a break-down guarantee of 12,000 volts on the secondary. He considers that the insulation of the secondary should successfully withstand this high-voltage test to prevent the primary current from reaching the secondary winding and the customer's premises. Oil insulated transformers are used exclusively, but the test is made dry, the oil being intended only for cooling purposes.

TWIN CONDUCTORS FOR SERVICE WIRES.—The query, "Are twin conductors desirable for service wires?" elicited at the Cincinnati Convention several opinions. Mr. Edward Slade said that he had found twin cable expensive, but invaluable for service wires, and much appreciated by customers. Mr. W. E. Holmes, of Newton, Mass., was of the opinion, arising from experience, that twin conductors are not desirable for service wires. He put in for secondary house service wires an iron pipe running from below in the street through the cellar wall, into which were drawn twin rubber-covered solid conductors with heavy outside braid. One of the conductors became grounded in the pipe, necessitating the withdrawal of the twin, and it was not found feasible to return the same when the break was remade and insulated, owing to the increase of size at the joint. Mr. Holmes has also used twin lead-covered cable built for 3,000 volts and used on 2,200. This was installed in an iron tube, but broke down after one year's service. In his opinion it is far better to use single conductors, particularly owing to the greater facility for repairs. Capt. Wm. Brophy said that the great advantage of the use of twin conductors is the reduction of fire hazard incident thereto, but the insulation between the wires should be much lower than the insulation between the same and the pipe in which they are carried.

NEW 10,000-VOLT PLANTS IN EUROPE.—A 10,000-volt plant is being erected at Kubel Herisau, near St. Gallen, Switzerland, which will supply Herisau and 15 surrounding towns with light and power. There will be four turbines direct-connected to polyphase dynamos and having a total output of 1,600 kw at 10,000 volts. Up to the present 101 transformers have been connected up, with a capacity of 3,000 kw, and 60 motors, of an aggregate capacity of 760 horse-power, to supply power for about 25 different classes of manufacturers. At Augsburg, Germany, a 10,000-volt polyphase plant is being installed, of a capacity of 4,500 kw in three turbine-driven units. There are also being installed three turbine-driven direct-current machines for an output of 1,000 kw, each at 220 volts. At Sinaia, Roumania, a 1,250-hp polyphase plant is being installed, the generators being direct-connected to turbines. Current will be transmitted to petroleum refining works 30 miles distant, the voltage being raised for this purpose by transformers to 11,000 volts. Seven turbine-driven polyphase generators of 1,600-hp each are being erected at Wangen, Switzerland, power being obtained from the river Aare, below Solothurn. Polyphase currents will be generated at 10,000 volts for distribution over territory the radius of which is 15 miles. All of the above plants are being erected by the Lahmeyer Company, of Frankfort, Germany.

NEW MEMBERS OF NEW YORK ELECTRICAL SOCIETY.—At the meeting of the New York Electrical Society on June 4, the following members were elected: C. T. Badger, Nutley, N. J.; Peter Bartsch, Governor's Island, N. Y.; W. H. Bradley, 412 Columbus Avenue, New York City; George V. Cooper, 133 S. 9th street, Brooklyn, N. Y.; Burch Foraker, 32 Gold street, New York City; Clarence P. Fowler, care Westinghouse Electric & Manufacturing Company, 120 Broadway, New York City; E. W. T. Gray, 120 Broadway, New York; Charles E. Hague, 39 Cortlandt street, New York; Samuel Hoexter, 609 W. 139th street, New York; Wiliam C. Hubbard, 120 Broadway, New York; Arthur W. Johnston, Prince's Bay, N. Y.; Oscar F. Kinzel, 39 Orange street, Brooklyn, N. Y.; John Langan, Okonite Co., 253 Broadway, New York; R. J. Louis, 25 W. 33d street, New York; Dwight D. Miller, 120 Broadway, New York; A. P. Munning, Cutler-Hammer Mfg. Co., 136 Liberty street, New York; Wm. Creighton Peet, 80 Washington Sq. E., New York; Grant B. Rossman, 209 W. 97th street, New York; Wilson Van Buren, 471 Fourth avenue, New York; Joseph Stehlin, 162 E. 93d street, New York; Harry F. Waite, M. D., 108 E. 23d street, New York; G. Harry Barbour, West New Brighton, N. Y.; Fred S. King, 84-86 Chambers street, New York; Lewis H. Nash, 248 Gates avenue, Brooklyn, N. Y.; Will J. Sando, 114 Liberty street, New York; W. L. Voorhis, 14 Cedar street, West New Brighton, S. I.; Adolph C. Martens and Herman A. Martens, 5 St. Mark's Place, New York; Thomas Kennedy, 2145 Second avenue, New York; Elliott T. Abel, 520 W. 51st street, New York; and Geo. D. White, 23 Manchester avenue, Paterson, N. J.

LETTER TO THE EDITORS.

The Longest Telephone Circuit.

To the Editors of the Electrical World and Engineer:

SIRS: In his answer to Prof. Pupin's criticism on modern telegraph methods, Mr. J. C. Barclay, of the Western Union, makes the statement that the greatest length of one continuous circuit operated by the telegraph company is from New York to San Francisco, 3300 miles, and that the longest telephone circuit operated is from New York to Omaha, 1466 miles. It may be of interest to Mr. Barclay and your readers to learn that the Cudahy Packing Company, from their main office, at South Omaha, Nebraska, have had a telephonic connection with the office of their New England manager, No. 1 Blackstone street, Boston, Mass., every morning, for from ten to twenty minutes, for the past four or five years, over the lines of the American Telegraph & Telephone Company. This makes a thorough circuit, by way of Albany, N. Y., direct to Boston, of about 1540 miles, and, as the circuit is quite often made up *via* Albany and New York, it would make it 150 miles or more, greater. Conversation is carried on very satisfactorily, indeed. This South Omaha-Boston telephone circuit is, I believe, the greatest distance that is regularly used, in daily business, in the world. In the case of the New York-San Francisco telegraph circuit, there are automatic repeaters every 300 to 500 miles.

SOUTH OMAHA, NEB. C. O. FITCH,
Chief Electrician, The Cudahy Pkg. Co.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Heyland Motor.—HEYLAND.—A communication in which he criticises a special point in the paper of Fleischmann and Orgler recently abstracted in the Digest. The Heyland motor, although self exciting, has all the characteristic properties of an induction motor and does not run synchronously at any load. It has not the disadvantages of ordinary "conduction motors" (called by Steinmetz commutator motors), namely, the pulsations of the field and sparking at the brushes.—*Elek. Zeit.*, April 17.

Osnos.—A communication in which he protests against Heyland's characterization of the old Goerges motor (1891) as a commutator motor; he says the Goerges motor does not belong to the ordinary type of series or shunt commutator motors. The Goerges motor ran at synchronism without phase difference, without sparks at the brushes, and without e. m. f. in the armature. The Goerges motor has a primary structure like the ordinary induction motor, *i. e.*, an iron ring; when it is supplied with three-phase currents, a rotary field is produced, and the effective e. m. f. in the armature becomes proportional to the slip and is zero at synchronism. He then reproduces a diagram of an ordinary commutator series motor from Steinmetz's book, in which the pole system is shown to consist of two diametrically opposite poles, like in a bipolar direct-current dynamo, so that under no circumstances can a rotary field be produced. Niethammer defines a conduction motor "as a motor the fixed and revolving windings of which are connected with the line, while the revolving part has a commutator;" if this definition is accepted, both the Goerges motor and the Heyland motor are conduction motors. Goerges' publication shows that he understood the problem and the means of solving it. It is peculiar that he did not follow up his invention. The writer believes that, eleven years ago, there was no need felt for induction motors and that later Goerges' invention was forgotten.—*Elek. Zeit.*, May 15.

Fleischmann and Orgler.—A reply to Heyland's criticism. They maintain that Heyland motor after it has been brought up to synchronism, will continue to run as a synchronous motor. The load at which it will begin to slip depends upon the rotor excitation and the breadth of the commutator segments.—*Elek. Zeit.*, May 15.

Latour.—A communication in which he refers to his patents for a self-exciting alternator. His first experiments have shown him that the commutation was "quite good for any load." "It is to be noted that on acount of the excitation winding being in short circuit through the brushes, there is a strong damping effect on field pulsations. For this reason, when large resistances are introduced into the excitation circuits, sparking can take place at the brushes."—*Elek. Zeit.*, May 22.

Induction Motors.—BERCKENBRINK.—An article, illustrated by diagrams, on the graphical determinations of starting torque and slip of induction motors as functions of the rotor resistance, by means of the Heyland diagram.—*Zeit. f. Elek.*, May 18.

Direct Current Armatures.—EICHBERG.—A communication referring to Arnold's recent paper on equipotential connections in the armatures of direct-current dynamos. He gives a graphical representation of the theory of the subject.—*Elek Zeit.*, April 17.

POWER.

REFERENCES.

Modern Practice in Rocking Valves and Valve Gears.—SCHMIDT.—An article profusely illustrated, dealing with the different types of valves and valve gears employed in modern steam engine practice, together with the reasons for the modifications of the original Corliss type of valve and gear.—*Amer. Elec.*, June.

Condensing vs. Non-Condensing.—HUBBARD.—An article illustrated with diagrams discussing the value of the condenser, and the advantages to be obtained by its use.—*Amer. Elec.*, June.

Compressed Air in Central Station and Railway Service.—WEEKS.—A short illustrated article giving the various uses to which compressed air may be put in and about central stations and railway repair shops.—*Amer. Elec.*, June.

Practical Polyphase Working.—BELL.—An article for those who know a little about direct-current and alternating-current dynamos and who desire to know something of the practical nature of modern polyphase apparatus. The article deals with the installation and operation of polyphase stations with especial reference to the power transmission work for which such apparatus is most extensively used. —*Amer. Elec.*, June.

TRACTION.

REFERENCES.

Calculating the Feeders for Electric Tramways.—SENGEL.—A mathematical article, illustrated by diagrams. In tramway installations relatively large variations of voltage are permissible and the watt losses are, therefore, of great importance. The cross section of the feeders of tramways is to be calculated from an economical point of view, *i. e.*, so that the sum of the costs for the watt losses in the lines and of the amount of interest and depreciation becomes a minimum. He describes a new mathematical method for calculating the feeders.—*Elek. Zeit.*, April 17.

Sieber.—A communication referring to Sengel's article. He refers to an older paper of his own, and criticises an assumption made by Sengel.—*Elek Zeit..*, May 8

Motive Powers for Launches.—ROBERTS.—A profusely illustrated article on electric, gasoline, and oil motor launches. "Of all the small-power boats, the electric launch probably approaches nearest to the ideal." Its drawback is that it is dependent upon an external source of power and that charging requires time. "Yet for many purposes these objections are not important, and the electric launch has a wide field of usefulness."—*Eng. Mag.*, June.

Surface Contact.—A well illustrated description of the new municipal electric tramway at Wolverhamptom. It is the first in Great Britain on which the surface contact system has been used on more than an experimental scale. The particular system used is that of Brown, constructed by the Lorain Steel Company.—Lond. *Elec.*. May 23.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

A Progressive and Profitable Small Central Station.—CRAVATH.—An illustrated article describing the plant of the Whitehall (Ill.) Electric Company. Besides giving an all-day service to a town of

2100 inhabitants, the company supplies the entire community with power, and pumps all of the water for the town by means of an electrically-driven pump situated one mile from the station and operated without an attendant. The generating plant contains one 60-cycle Westinghouse single-phase alternator of 60 kw capacity with a composite wound field. This machine delivers current at 2200 volts and is belt driven from a simple high speed engine. This unit supplies all incandesent lighting and power. Arc lights are supplied from a 220-volt direct-current dynamo. The arcs are operated four in series across the 220-volt mains. Separate half-circuits are run from the power-house for each series of four, and a single common return wire is used for all circuits. The arc lamps are lighted only on nights other than moonlight and then only until midnight. An ingenious arrangement is provided at the pump-house, whereby the motor may be started without load. A double-pole switch at the station throws the motor feeder on the bus-bars. The discharge of the pump is by-passed, which when open, allows the pump discharge to flow directly back to the reservoir with no pressure. The pressure from the waterworks tank and main is kept back from the pump by an ordinary check valve in the discharge. The by-pass valve is of the gate type and is operated by a small hydraulic cylinder and piston. As soon as the motor gets up to speed the action of a governor, which throws the brushes off the commutator, moves a valve which controls the supply to the hydraulic cylinder. The piston then proceeds to slowly close the by-pass valve, and as soon as this valve is sufficiently closed the pump begins to work against the pressure in the mains. The small hydraulic controlling valve is worked by a rod and lever connected mechanically to the brushes of a Wagner motor which drives the pump. The various potteries about the town take a considerable portion of the day-load and in order to offset the effect on the voltage regulation of the system, it was found necessary to provide heavy fly-wheels on the motor shafts and countershafts, besides a regulator at the alternator.—*Amer. Elec.,* June.

Tariff.—CLARK.—An article on "the profitable supply of electricity, and the City of London Elec. Lighting Co.'s tariff." This is one of the very few companies that use a Hopkinson form of tariff without a demand indicator. The present charge, *viz.*: 16 cents per unit for the first six units per quarter per lamp connected during the six winter months, and for the first three units per quarter per lamp for the six summer months, and four cents per unit thereafter, has been in force throughout 1901. Before, in 1900, the charge during the earlier part of the year was a flat rate of 9 cents, and, later, a tariff of 16 cents for the first four units per quarter per lamp in winter, and two units per quarter per lamp in summer, and 4 cents thereafter. The results of the new tariff are analyzed and shown to be very unsatisfactory; the tariff is proving detrimental to the welfare of the undertaking and the absence of the maximum demand indicator is doing a good deal of mischief. The present tariff tends to eliminate all the lamps which can be spared with a little inconvenience and which otherwise would be installed—Lond. *Elec.,* May 23.

REFERENCES.

Electric Installation in a Music Hall.—An illustrated description of the electric installation of the Burk Temple of Music in Chicago. There are two steam-driven 60-kw direct current generators, a straight 110-volt service being supplied throughout the building for lighting and power.—*West. Elec.,* May 31.

Summary of the Alternating Current System.—REIST.—An article reviewing the alternating current field and comparing the different systems of distribution. The author also compares the different apparatus used in the generation, transmission, regulation and application of alternating currents—*Amer. Elec.,* June.

Cardiff.—A very long and profusely illustrated description of the equipment of the Cardiff electric tramway station. There are at present installed four steam driven generating sets, each of 300 kw; also a storage battery of 56 cells, capable of giving 210 amp. for 10 hours or 540 amp. for 3 hours, for station lighting.—Lond. *Elec. Eng.,* May 16.

WIRES, WIRING AND CONDUITS.

Fuses in Branched Circuits.—SENGEL.—An illustrated article in which he discusses the placing of fuses in such branch circuits which are connected to the mains at both ends, and in which the current can flow to the consuming apparatus from the two different ends. He gives the following rules: "All conductors which can be supplied with current from both ends are to be provided at both sides with fuses corresponding to the cross-section of the conductors. The fuses may be omitted on single lines, if their allowed supply current strength at least equals the sum of the supply current strengths of the other conductors leading to the same point. If from such conductors other lines branch off which do not receive current from any other side, then fuses must be provided corresponding to their cross-section, if their allowed supply current strength is smaller than the sum of the current strengths to which the fuses correspond which serve for the protection of the main conductor." —*Elek. Zeit.,* May 1.

Cable Laying Plough.—A description of a new form of plough, devised by Bajac for laying cables over soft ground, chiefly for telegraph work. It is a large and heavy apparatus on two wheels, with a beam sliding in vertical guides, and operated by worm gearing to give the necessary depth to the share. This latter is formed of two steel plates with a cutting edge, and in front are two cutters to loosen the soil ahead of the main share. A cable drum is mounted on the rear end of the plough, the cable passing around rollers to the cutting which has been made by the plough, the drum revolving and paying out the cable as the plough proceeds. A traction engine with winding gear does the necessary hauling, like in steam ploughing, distances of 200 yards being cut and laid in a stretch. A speed of about 1¼ miles an hour is possible over soft soil. The apparatus is to be used by the French government for the laying of a trans-African cable.—Lond. *Elec.,* May 23.

Cable Laying in the Bed of a River.—An illustrated note on cable laying across the river Tawe, in South Wales. This became necessary in order to supply an outlying position of the town; four concentric cables, each of 0.048 sq. in. section, were laid for transmitting single and two-phase currents of 50 cycles at a pressure of 3,000 volts. The dielectric consists of impregnated paper which is lead sheathed, and over it is a covering of vulcanized bitumen. Outside this is a heavy yarn and armoring of double layers of galvanized steel wires, the whole being finally yarned and compounded. The cables are laid in a shallow channel in the bed of the river.—Lond. *Elec.,* May 23.

REFERENCE.

Calculation of Networks.—SOSCHINSKI.—An article, illustrated by diagrams, in which he discusses by simple graphical methods, several problems in the calculation of networks.—*Elek Zeit.,* April 24.

ELECTRO-PHYSICS AND MAGNETISM

Interference Tubes for Electric Waves.—BECKER.—An account of experiments with two forms of Quincke interference tubes used for measuring the length of electric waves. One of the forms consists of a tube with two branches, like a branched circuit, while the other has the shape of a T. In both cases the length of the wave transmitted by the tube does not depend upon the length of tube, but upon the diameter. The wave length is about 1.6 times the diameter. The waves travel along the surface of the metallic tubes and emerge into the air with a barely diminished intensity. The first form of interference tube acts as a polarizer, which only transmits vibrations which are parallel to the plane of the branches. If the stem of the T-tube is filled with insulating liquids, the wave length in the interior of the liquid may be determined, and a comparison of this with the wave length in air gives the dielectric constant of the liquid. The dielectric constant may be determined by two other methods, one of which involves the reflection of the waves by a mirror.—*Ann. d. Phys.,* No. 5; abstracted in Lond. *Elec.,* May 16.

Effect of Inductance upon Spark Discharges.—EGINITIS.—A study of the heat effects on the poles of a spark-gap as affected by a variation of the inductance of the circuit. He uses a Telsa coil without a core, and discharge points of thin wire of various metals. At first the brightness of the aureole of the spark varies inversely as the heating effect for all metals examined. At high inductances both the temperature and the brightness of the spark increase with increasing inductance, at least for iron and nickel points. He made a closer study of the effects by determining the temperatures of the discharge points with the aid of a thermo-electric couple. The metals examined included iron, nickel, aluminum, copper and silver. The heating effect is of a very complex nature. It first increases rapidly with increasing inductance, and then breaks into a succession of maxima and minima. A rough generalization arrived at is that the metals whose heating is very great are also those whose spectra are enriched by an increase of inductance, as is the case of the highly-magnetic metals. The presence of metallic vapor is not a primary factor in the heating effect, as is shown by the fact that at small inductances the brightness of the spectrum decreases with increasing

inductances, whereas the heating increases very rapidly.—*Comptes Rendus,* May 5; abstracted in Lond. *Elec.,* May 23.

Resistance of a Magnetic Field.—PELLAT.—A paper in which he gives some further evidence in favor of his contention that there is a kind of friction across the tubes of magnetic force which makes the electric corpuscles tend to run along them rather than across them. A cylindrical tube, which shows a good stratified discharge, is placed between the cylindrical polepieces of an electromagnet so that the middle part is embedded in a strong magnetic field at right angles to the axis of the tube. As long as the field has not more than some 425 units, the anode stream is deviated in the well-known manner, forming a thread along the wall of the tube, and getting thinner and brighter with an increasing field. But if the field is increased to about 7,000 units, the anode light fills the whole tube uniformly, without stratifications, and the resistance of the tube increases some 24 times. If now a second and thinner tube is fused into the first, so as to form a branch circuit, which does not pass through the strong magnetic field, the whole discharge passes through this branch tube, just as if its resistance were enormously less than that of the main tube. When the lines of force run along the tube instead of across it, the anode stream traces out the lines of force.—*Comptes Rendus,* May 5; abstracted in Lond. *Elec.,* May 23.

Ions in the Atmosphere.—EBERT.—A description of experiments showing the ionic charge of the atmosphere. A plate of tinned iron, 2 square meters in area, was supported 4 meters above the earth's surface on insulating pillars, planted on the top of a slope 70 meters high, overlooking the river Isar. On a day when the weather was fine, the plate was first connected to earth and acquired a negative charge. It was then disconnected and left to itself for some time, so as to acquire the potential of the surrounding air. Finally it was earthed through a galvanometer, and showed a current proceeding from the plate to the earth. The exposure necessary for acquiring the potential was greatly shortened by covering the plate with sods of grass, the time then required being usually about five minutes. The charges acquired varied within wide limits with the weather, being largest in fine and smallest in foggy weather. This shows that the convection of negative ions from the atmosphere to the earth varies in accordance with their mobility in the atmosphere.—*Phys. Zeit.,* May 1; abstracted in Lond. *Elec.,* May 23.

Velocity of Ions from Hot Platinum Wires.—CHILD.—An account of a continuation of his researches. The principle results are as follows: The particles from a hot platinum wire have a greater retarding action on the negative ions drawn from a flame than on the positive. In hydrogen the rate of discharge is much larger than in air. The behavior of the wire in oxygen, carbon monoxide and carbon dioxide is practically the same as in air. The experiments seemed to indicate that the particles are driven off as platinum and not as some oxide of platinum. The ionization appears to occur first within the wire and there are some reasons for thinking that this part of the ionization is produced from occluded hydrogen.—*Phys. Rev.,* May, June.

Influence of Inductance upon Spectra.—DE GRAMONT.—An article in which he shows that while in the direct spectrum analysis of minerals, the spectra are usually complicated by the presence of prominent "air lines" and lines belonging to certain metalloids, the introduction of feeble inductances in the circuit produces a great simplification of the spectra and elimination of those disturbing lines. The air lines are greatly reduced by inserting an inductance of only 0.00002 henry, and are entirely eliminated by three or four times that inductance. A slightly larger amount suffices to get rid of the rays due to sulphur. "In a mixture of selenium and sulphur the selenium may be obtained alone by eliminating the sulphur and keeping the inductance below 0.00023 henry, the value at which the most persistent of the green selenium rays disappears." Phosphorus is a substance whose spectrum disappears comparatively easily; it is slightly more persistent than sulphur.

Vacuum Tubes.—GOLDSTEIN.—An article on an optical illusion in vacuum tubes. The outer side of the glass wall of a vacuum tube which is traversed by cathode rays, is apparently luminous whenever the wall of the tube is thin in comparison with its diameter. This optical illusion produced by a thin wall is similar to the one which makes the water in a tumbler, or the mercury in a thermometer bulb, appear to penetrate the glass itself, whereas the thread of mercury in the stem apears only slightly enlarged. A film of glass of red luminescence, stuck on the inner wall of a tube, and struck by cathode rays, makes the outer wall apparently red instead of green. When the gas and not the inner wall is luminous, the rays from it do not undergo the refraction necessary to produce the optical illusion. This fact furnishes an important criterion to distinguish between canal rays, which only affect the gas, and cathode rays, which affect the wall.—*Ann. d. Phys.,* No. 5; abstracted in Lond. *Elec.,* May 16.

REFERENCES.

Wattless Currents.—FELDMANN.—A lecture held before the Cologne Electrical Society in which he gave a general review of the phenomena due to wattless currents in alternating current engineering.—*Elek. Zeit.,* April 24.

Temperature Variation of Electric Resistances.—WILLIAMS.—A paper on the temperature variation of the electrical resistances of pure metals, and allied matters. Various tables are given and three formulas for the specific resistance, the temperature factor, and the specific heat, are given, which hold good for limited groups of metals. *Phil. Mag.,* May.

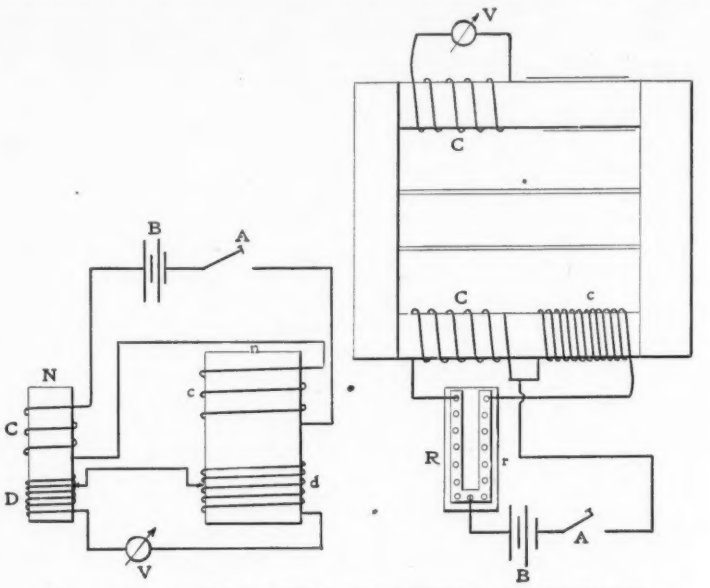
Becquerel Rays.—TOMMASINA.—An account of an experimental investigation of the absorption of Becquerel rays—which is of importance as it imparts to gas a conductivity due to ionization, and also increases the conductivity of liquid and solid dielectrics.—*Comptes Rendus,* April 21; abstracted in Lond. *Elec.,* May 9.

Magnetic Elements.—BEATTIE AND MORRISON.—A summary of the determinations of the magnetic elements at the Cape of Good Hope from 1605 to 1900.—*Phil. Mag.,* May.

Magnetism Induced in Iron by Rapidly Oscillating Current Fields.—VARLEY.—An account of a series of experiments in which he investigated the magnetization of iron in a rapidly alternating field and showed how the induced magnetization depends on the strength and frequency of the field, and on the diameters of the wire used.—*Phil. Mag.,* May.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Zero Method for Magnetic Measurements.—GOLDSCHMIDT.—An illustrated description of a simple zero method for magnetic measurements which can be used for numerous purposes. In Fig. 1,



FIGS. 1 AND 2.—ZERO METHOD FOR MAGNETIC MEASUREMENTS.

herewith, the fluxes N and n of lines of magnetic induction which are produced by two coils C and c in two iron cores may be compared by connecting these coils with a battery B and a switch A and placing on the two iron cores two extra windings D and d which are connected together in series with a millivoltmeter V as shown in Fig. 1. The arrangement is so made that when the primary circuit is broken at A, the e. m. fs. induced in D and d have opposite directions. By varying the number of the turns of these auxiliary windings D and d, the e. m. fs. induced in both can be made exactly equal and opposite; the needle of the voltmeter V will then be at zero. In this case the two fluxes N and n have the same relation to each other as D to d. The method allows of very exact measurements. He describes its application for measuring the stray field of a direct current dynamo, for determining the counter-amperewindings of a direct current armature for different positions of the brushes, for determining magnetization curves, etc. Instead of changing the number of turns of D and d, one may keep them con-

stant and instead supply the windings *C* and *c* with different and adjustable currents. This is done, for instance, in the following method for determing the ratio of transformation of a transformer shown in Fig. 2. The primary and secondary coils *C* and *c* of one arm of the transformer are connected to the battery *B* and switch *A* through two variable resistances *R* and *r* respectively, for which purpose an ordinary resistance box may be used. The millivoltmeter *V* is connected to the primary winding of another arm of the transformer. The resistances *R* and *r* are varied until the voltmeter shows no deflection when the circuit of *C* and *c* is broken at *A*. The ratio of transformation is then *R* to *r*. The method is said to give very exact results. —*Elek. Zeit.*, April 10.

Fluxograph.—BLONDEL.—An abstract of a French Phys. Soc'y paper in which he described a new apparatus for registering the curves of magnetic flux in any circuit. A search coil is wound round the magnetic circuit and connected to the primary circuit of a transformer containing no iron, the secondary of which is connected to the fluxograph. The latter is a galvanometer without directing torque or damping effect. A cycle of variation of the needle deflection reproduces the cycle of variation of the flux. For developing the curve of variation of this angle as a function of the time, he uses a mirror revolving at uniform speed, as is already used with his oscillograph. An iron box enveloping the meter coil prevents any influence from an outside magnetic field of force. The coil is fixed, and acts on a moving magnet resting on pivots and enclosed in a vacuum tube. He states that many applications may be added to the one above pointed out. For registering directly the magnetizing cycle of an iron sample, he replaces the rotating mirror by an oscillating plane mirror mounted on a galvanometer with a horizontal axis.—Lond. *Elec.*, May 23.

Induction Coil.—IVES.—The first part of a long illustrated paper, giving "contributions to the study of the induction coil." He treats two cases, that of a single break and that of a simple harmonic e. m. f. in the primary. He gives the mathematical theory of these two cases and then describes the instruments and methods used in his experiments. To determine the effect of increasing the amount of iron in the core, the number of iron wires inserted in the core was varied, the current being kept constant; the potential increases very rapidly as the number of wires is increased up to a certain point, after which an increase in the number of wires only makes a small difference in the potential. He could not find that it made a difference whether the iron wires were placed in a bundle in the middle of the core or placed loosely anywhere within it. He then investigated the distribution of the flux of induction through the primary at different points of its length, the results being given in tables and diagrams. He also determined the effect of inserting localized capacity in the secondary of a small induction coil; the potential of the secondary may be increased in this way in some cases. He gives tables and curves from which can be found the value of the secondary capacity which will give the greatest difference of potential in the secondary for a given frequency.—*Phys. Rev.*, May, June.

Electric Micrometer.—SHAW.—A Brit. Phys. Soc'y paper in which he describes an instrument for measuring very small lengths by the application of electric contacts. A screw fitted with a milled head, turns in a fixed nut and its lower end presses upon the extremity of the long arm of a lever. A metal point is attached to the short arm and the distance through which it moves, on turning the milled head, can be deduced from a knowledge of the pitch of the screw and the ratio between the arms of the lever. In using the instrument this point is always brought up to a metal surface and the contact is accurately determined by a telephonic arrangement. He describes the application of the instrument for different purposes; the measurement of the thickness of plates, films, or fibres; the determination of Young's modulus; the determination of simple rigidity; measurement of thermal expansion, microscopic measurements; and measurement of the wave length of light.—Lond. *Elec.*, May 23.

Roentgen Ray Apparatus.—WALTER.—A detailed illustrated description of his set of Roentgen ray apparatus. He uses a Wehnelt break with direct current. The voltage should not be much higher than 80. He recommends using a shunt in parallel with the interrupter and the primary of the induction coil; the arrangement is illustrated in a diagram. The softer the X-ray tube to be excited, the greater must be made the self-induction of the coil in order that the breaks in the Wehnelt interrupter take place with regularity. He therefore uses a "coil with variable self-induction," the primary being wound with several separate layers of wire, the ends of which are connected to a switchboard. He uses a "multiple Wehnelt interrupter," *i. e.*, a break with several platinum pencils of different lengths. By changing the length of the pencil, the current strength of the single discharges of the induction coil is changed with very little change in the spark length. In this way it is possible to work a tube either with a large number of single discharges of small current strength (short pencil) or with a small number of discharges of large current strength (long pencil).—*Fortschr. Geb. d. Roentgenstr.*, v. 5, p. 1; Lond. *Elec. Rev.*, May 9.

Scale of Periodicity.—GUILLEMIN.—An article in which he deals with the choice of a standard interval. In acoustics the standard intervals used are the octave, 2 to 1, and the comma. The author suggests the ratio 10 to 1 as the standard intervals, and calls it the "savart." The logarithm of this ratio is unity, which means a great simplification of numerical calculations. Savarts would be measured by a logarithmic scale, and thus the "millisavart" would be the ratio whose logarithm is 0.001. This ratio would be 433 to 434 and the natural definition of standard international pitch would be 434.3 vibrations per second. The millisavart may be variously defined as the ratio of two notes giving one resultant beat per second, or as the ratio between two periodicities differing by one vibration per second, or as the number 1.002305, whose logarithm is 0.001. All these definitions are concordant.—*Comptes Rendus*, April 28; abstracted in Lond. *Elec.*, May 16.

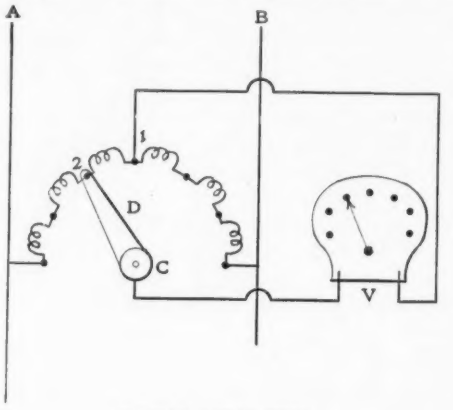
REFERENCES.

Handy Insulation Test and Some Shop Notes.—MUNROE.—A short article illustrated by diagram, giving a handy insulation test which may be made with a Weston voltmeter, and also giving some shop notes of value.—*Amer. Elec.*, June.

A Mercury Interrupter.—DEL MAR.—An illustrated article describing a simple and portable form of mercury interrupter actuated like a common vibrator, by the magnetism of the induction coil core.—*Amer. Elec.*, June.

TELEGRAPHY. TELEPHONY AND SIGNALS.

Signal Apparatus.—HEUBACH.—A long and profusely illustrated paper read before the Berlin Electrical Society on the new signal apparatus of the Union Electric Company of Berlin, as used more especially on ships for transmitting rudder signals. The voltmeter



SIGNAL APPARATUS.

principle is used; but for this purpose a strong damping effect must be provided. The arrangement is shown in the adjoining diagram; *A* and *B* are the feeders, *V* is the receiving instrument, designed as a voltmeter. The transmitting device consists of a number of resistances bridged across the feeders and a handle *D* which can be turned around *C*. It is at once evident from the diagram that the voltmeter *V* measures the e. m. f. between the fixed point 1 and the variable point 2, to which the handle *D* is connected. In practice a receiver and a transmitter are placed at both ends; the commander gives a signal to the attendant who in turn sends it back so that the correct understanding of the transmitted signal is guaranteed. Two diagrams are given which show two different forms of connections for this purpose. To get a good damping effect, a short needle is used, and a large scale is obtained by a special arrangement of the pole-pieces. The instrument is practically free from errors due to insulation faults. When storage batteries or motor-generators are used for supplying the current to the signal apparatus, the errors due to variations of voltage are avoided, because motor-generators can be so designed that the dynamo delivers current at approxi-

mately constant voltage, while the voltage of the current which feeds the motor, varies considerably. In cases in which the current for the signal apparatus is taken directly from the lighting circuit they use either special iron rheostats or insert into the feeders a small series motor the counter e. m. f. of which varies and counteracts the variations of the supply of voltage. He discusses at some length telegraph apparatus to the boiler rooms and describes some special arrangements for this purpose. In the discussion which followed the paper, Querengaesser described the revolving field apparatus of the Gen. Elec. Co. of Berlin which have been noticed before in the Digest (they are operated with direct current.)—Elek. *Zeit.*, April 3.

REFERENCE.

Block Signals.—KINSEY.—The first part of an illustrated paper, read at the Dublin section of the (Brit.) Inst. Elec. Eng., on "railway blocks and telegraphs—recent practice" on the railways in Ireland. He discusses the extension of block-signal working where double lines of rails exist, and the introduction of the train staff block instrument where there is only a single line of rails.—Lond. *Elec.*, May 23.

MISCELLANEOUS.

REFERENCE.

Kelvin.—CROCKER.—A brief account, with portrait, of the work of Lord Kelvin and its influence on electrical engineering.—*Eng. Mag.*, June.

New Books.

ENGINEERING EDUCATION. Proceedings of the Society for the Promotion of Engineering Education. Buffalo Meeting, 1901. Vol. II. New York: Engineering News Publishing Company. 348 pages, 4 illustrations. Price, $2.50.

This volume contains a full report of the proceedings of the Buffalo convention of the Society, which enrolled 261 members from 36 States, 1 Territory, Canada, and 3 foreign countries. The Convention covered 3 week-days and included both morning and afternoon sessions, a praiseworthy programme considering the proximity of the Pan-American Exposition. Forty-six members registered, or 17.6 per cent. of the enrolled membership. The proceedings contain, in addition to routine business, a presidential address, and twenty papers.

These papers—not omitting the address—are very interesting reading to any technologist. They are all written by men of education and standing, and consequently their perusal bestows pleasure. They also differ materially in their standpoint and advocacy. It would evidently be impossible to obtain engineering educational courses that would please all the members; but the essentials in which unanimity presides are uplifting and point out the trend of engineering development. The Society is evidently bent upon doing good work, and the attainment of its aims means the development of higher civilization. The book is carefully prepared, well printed, enjoyably readable and should be on file wherever engineering is studied.

CONTRIBUTION A L'ETUDE DES PERTES D'ENERGIE DANS LES DIELECTRIQUES. By Paul L. Mercanton. Lausanne: Imprimerie Corbaz & Company. 63 pages, 8 plates.

The above is a reprint of a thesis presented to the faculty of Lausanne University for the degree of Ph.D. It is divided into two portions; the first, occupying 26 pages, deals with the history of the theory of loss of energy in dielectrics subjected to harmonically varying electrostatic force. The principal theories discussed are those of Maxwell, Hess, Houllevigue, Mascart and Pellat. The two former writers invented special conceptions for empirically treating the residual dielectric charge. The three latter writers introduced molecular theories of polarization. None are perfectly satisfactory. A bibliogical table is appended.

The second part, occupying 35 pages, describes an experimental research conducted in 1900 and 1901 upon the subject. To obtain a cyclically-varying e. m. f., a circular paraffine trough was filled with acidulated water and subjected to a constant e. m. f. by a pair of diametrically opposite electrodes. A small electrode dipping in the trough was made capable of revolving around the trough at speeds up to 4 revolutions per second. The dielectric under test, in the form of a single sheet condenser was connected to the movable dipping electrode and thus subjected to a zig-zag shaped e. m. f. at variable frequencies up to 4 periods per second. By a special mechanism the charge of the condenser was examined at different successive stages of the cycle. Owing to residual charge, the charge did not follow the impressed voltage, but lagged hysteretically and the diagrams to rectangular co-ordinates of voltage and charge resemble the hysteretic, bean-pod diagrams of iron. The most marked hysteresis was with ice, and the least with paraffine.

The hysteretic loss of energy increased with the impressed e. m. f. approximately as the square, but rather in excess thereof, or at a slightly faster rate than the square.

The experimental results are interesting and the thesis is a useful addition to the literature of the subject. The descriptions, however, are involved and the paper is by no means lucid.

BOOKS RECEIVED.

HANDBOOK FOR STREET RAILWAY ENGINEERS. By H. B. Andrews. New York: John Wiley & Sons, 202 pages, 41 illustrations. Price, morocco, $1.25.

DIE GLEICHTSTROMMASCHINE. Theorie, Konstruktion, Berechnung, Untersuchung und Arbeitsweise Derselben. By E. Arnold. Berlin: Julius Springer. 555 pages, 421 illustrations. Price, 16 marks.

DER ELEKTRITSCHE BETRIEB VON FERNSCHNELLBAHNEN. By Gustav W. Meyer. Halle a. s.: Wilhelm Knapp. 63 pages.

DIE ELEKTROLYSE DES WASSERS IHRE DURCHFUHRUNG UND ANWENDUNG. By Viktor Engelhardt. Halle a. s.: Wilhelm Knapp. 117 pages, 90 illustrations. Price, 5 marks.

ELECTRICAL AND MAGNETIC CALCULATIONS. By A. A. Atkinson, M.S. New York: D. Van Nostrand Company. 310 pages, 45 illustrations and wiring tables. Price, $1.50.

STANDARD POLYPHASE APPARATUS AND SYSTEMS. By M. A. Oudin, M.S. Third edition, revised. New York: D. Van Nostrand Company. 289 pages, 169 illustrations. Price, $3.00.

THE ELECTRIC ARC. "The Electrician" Series. By Mrs. Hertha Ayrton. New York: D. Van Nostrand Company. 479 pages, 146 illustrations. Price, $5.00.

"THE ELECTRICIAN" ELECTRICAL TRADES' DIRECTORY AND HANDBOOK FOR 1902. London: "The Electrician" Printing and Publishing Company, Limited. 1,422 pages. Price, 12 shillings, sixpence.

THE BALANCING OF ENGINES. By W. E. Dalby, M.A., B.Sc. New York: Longmans, Green & Company. 283 pages, 173 illustrations. Price, $3.75.

ARMATURE WINDINGS OF DIRECT CURRENT DYNAMOS. Extension and Application of a General Winding Rule. By E. Arnold. Translated from the German by Francis B. DeGress. New York: D. Van Nostrand Company. 124 pages, 146 illustrations. Price, $2.00.

DIE FUNKENTELEGRAPHIE. By A. Slaby. Berlin: Leonhard Simion. 119 pages, 32 illustrations.

Directory of Electrical Societies, Etc.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Next meeting, Pittsburg, June 28 to July 3, 1902.

AMERICAN ELECTOCHEMICAL SOCIETY. Next meeting, Niagara Falls, N. Y., Sept. 15, 16 and 17, 1902.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Annual convention, Great Barrington. Mass., June 18-21, 1902.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, Detroit, Mich., Oct. 8, 9 and 10, 1902.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Next meeting, Chicago, June 18, 1902.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Next meeting, September, 1902.

ELECTRICAL CONTRACTOR'S ASSOCIATION OF NEW YORK. Semi-Annual meeting, Hotel Ten Eyck, Albany, N. Y., July 15, 1902. Pittsburg, June 27 and 28, 1902.

INDEPENDENT TELEPHONE ASSOCIATION OF WISCONSIN. Next meeting, Waupaca, Wis., June 25, 26 and 27, 1902.

INDEPENDENT TELEPHONE ASSOCIATION OF THE UNITED STATES. Next meeting, Philadelphia, Pa., June 24, 25 and 26, 1902.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Next meeting, Richmond, Va., Oct. 7, 8 and 9, 1902.

NATIONAL ELECTRICAL CONTRACTOR'S ASSOCIATION. Annual meeting, Hotel Walton, Philadelphia, July 16, 1902.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Next meeting, Chicago, May, 1903.

NEW YORK STATE STREET RAILWAY ASSOCIATION. Next meeting, Caldwell, N. Y., Sept. 9 and 10, 1902.

NORTHWESTERN ELECTRICAL ASSOCIATION. Next meeting, Waupaca, Wis., June 25, 26 and 27, 1902.

OHIO STREET RAILWAY ASSOCIATION. Next meeting, June, 1902.

OLD-TIME TELEGRAPHERS' ASSOCIATION AND UNITED STATES MILITARY TELEGRAPH CORPS. Next meeting, Salt Lake City, Utah, September, 1902.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Next meeting, October, 1902.

SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION. Next meeting, Pittsburg, June 28 to July 3, 1902.

THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Annual meeting, Hotel Kaaterskill, Catskill Mountains, N. Y., Sept. 2, 3 and 4, 1902.

Works and Products of the Stanley Electric Manufacturing Company—I.

BERKSHIRE County is a scenic leader. Between the Hoosac and Taghconic mountain ranges the valley of the Housatonic, lying 1,000 to 1,200 feet above tide water, presents a panorama of surpassing interest for fifty miles. Here are found the highest mountains, the deepest ravines, the greatest waterfalls and the most extensive forests of the Commonwealth. Greylock Peak, 3,500 feet above the sea; October Mountain, with its varied colors; the Stockbridge Bowl; Icy Glen; Worthington Falls, with a plunge of 76 feet; the Green River, and Sky Farm are only a few of the natural wonders that claim the attention of the fortunate traveler in this valley.

Sociologists attempt to trace connections between the natures of men and their natural surroundings. How far the rugged lines of Berkshire scenery have influenced the industrial conditions of the people there, who shall say? In its chosen lines of manufacture the county has long stood at the front as to quality of its products. Cotton prints are here produced of an excellence not attained elsewhere in the State. Everyone who passes a United States legal tender note handles paper that has enjoyed a practical monopoly for decades, because its like is not produced outside of Berkshire County. So in the field of electrical development, those who would describe the longest transmission of water that the world has seen must refer to machinery made by the Stanley Electric Manufacturing Company, of Pittsfield, by which it is being carried out.

The history of this company differs from that of most of the other large electrical manufacturers. Such companies have usually been formed to produce one or more of the main elements of a lighting or power system, as arc dynamos or power generators, and have subsequently taken up the minor parts of electrical equipments. With the Stanley company this order has been reversed. At its start this company began the manufacture of a moderate line of lighting transformers as its main product. The manufacture of transformers led to that of generators for their operation. Managers of the company early saw the great importance of long electrical transmissions at high voltages, and large station transformers were designed to give the necessary pressures. Long transmissions of energy in large units imply the ability to render any sort of electrical service at the substations. To meet these requirements frequency changers and rotary converters have been added to the products of the Stanley company. With the rapid application of alternating generators to the work of street railways, the railway motor has come to be an important adjunct to alternating systems, and the company have just added a line of such motors to their products.

The new works of the Stanley company are on a tract of about 30 acres in the suburbs of Pittsfield, on both sides of the main line of the Boston and Albany Railway. The various buildings of the manufacturing plant have a total floor area of about 180,000 square feet. Most of these buildings are of brick, but the largest is a combination of brick, wood and iron. Distribution of electric power to a large industrial works from a single steam plant finds an excellent illustration in the present case. Power for the operation of the Stanley shops is developed in a brick building, devoted exclusively to that purpose, and located about one-fourth mile from the center of the main machine shop. This steam power plant stands on the bank of a sheet of water, known as Silver Lake, from which supplies for boiler feed and condensing purposes are drawn. Water from this lake passes through a live steam purifier before entering the boilers. Four Dillon boilers of the return-tubular type, and rated at 600 hp, supply steam for the engines at 140 pounds gauge pressure. A short iron stack takes the place of a chimney with these boilers, and induced draft of any desired pressure is obtained with blowers. Three engines, one McIntosh & Seymour tanden-compound, rated at 300 hp; one Ball & Wood simple, rated at 200 hp, and one Erie-Ball tandem-compound, of 100 hp, are belt connected to a jack-shaft running along one side of the engine and generator room. Eight main dynamos with their exciters are driven from this shaft by belts, and the shaft is supplied with quilles and clutches, so that it may be split up into sections, each driven by a separate engine.

The generator equipment includes six alternators, with an aggregate capacity of 900 kw at 2,400 volts, with cycles ranging from 94 to 133 per second; also two dynamos of 320 kw, aggregate capacity for the supply of direct current at 220 volts. A ten-ton crane sweeps the entire generator room and makes changes easy. At present this generating plant is much overloaded, owing to the rapid increase in the volume of work passing through the main shops, so that the largest engine is operated much of the time at 400 to 500 hp. To do away with this condition, a new generator of 600-kw capacity, direct-connected to a cross-compound engine will shortly be installed at the power-house. Energy is conveyed from the power plant to the manufacturing plant by a number of overhead circuits that pass under the railway tracks through a tunnel.

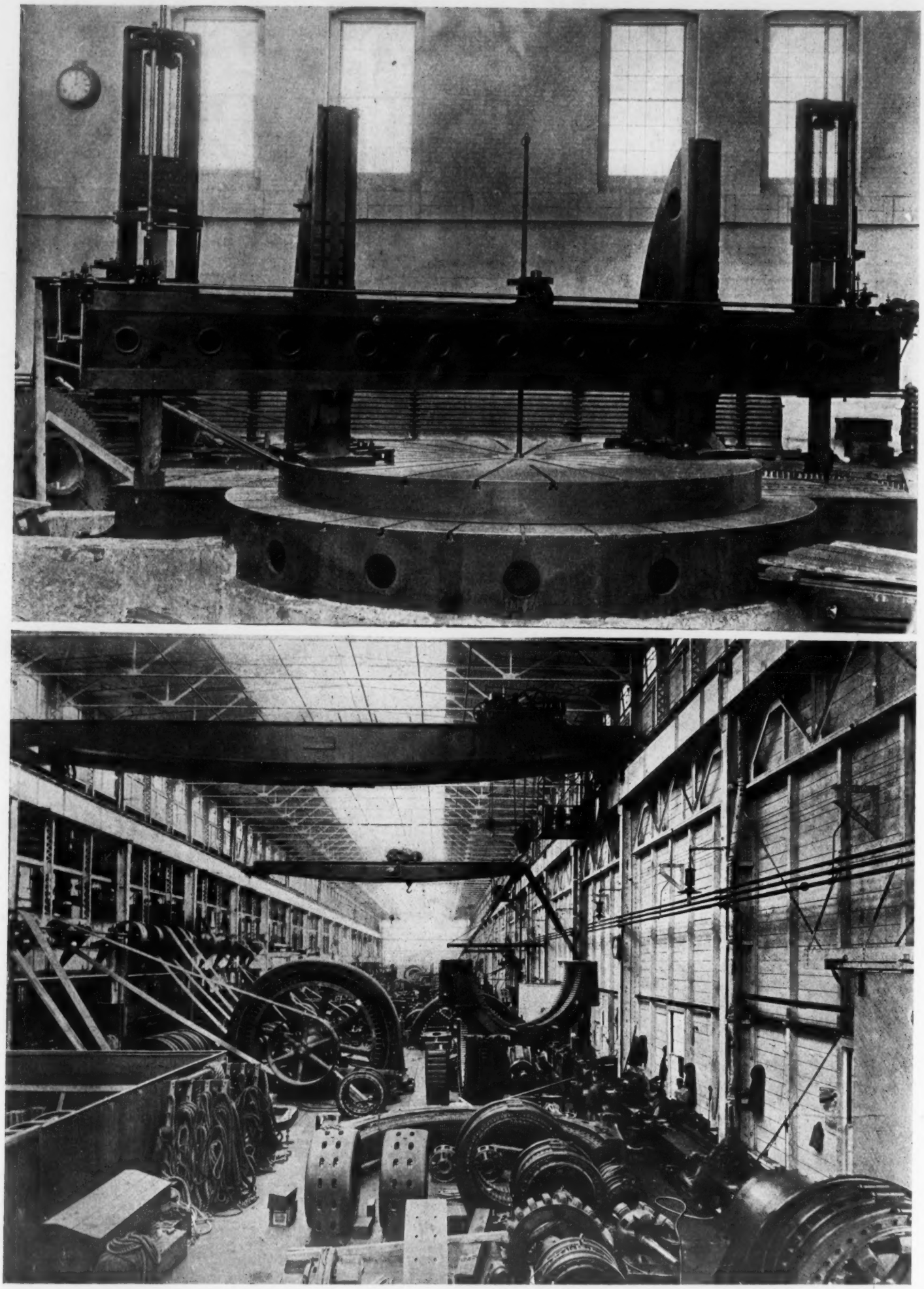
A small portion of the energy from the generators just considered is used for general lighting and testing purposes about the works, but the greater part of it passes into motors that drive the machine tools. Two general classes of motors are in use, namely, those taking direct current at 220 volts, and polyphase motors operating at 500 volts. Current at different frequencies from the alternators above-mentioned is supplied to the polyphase motors as desired for purposes of speed regulation. The majority of all motors in use are belted either to individual machine tools or to short lines of shafting, by which such tools are driven. In a few cases, however, the motors are geared or direct connected to the driven machines. Thirty direct-current motors are in use throughout the works with an aggregate rated capacity of 540 hp. Alternating motors number 48, and their combined rating amounts to 412 hp. Considering both kinds of motors, the total number throughout the works is 78, and their combined capacity 952 hp. The numbers of motors of each capacity and type are as follows:

Direct-current.		*Alternating.*	
Number.	*hp.*	*Number.*	*hp.*
1	½	4	¼
4	1½	2	½
2	2	2	1
4	3	6	3
4	5	4	5
2	7½	2	2
4	10	8	7
4	15	4	10
1	20	14	15
1	22½	2	30
1	40		
2	150		
30	540	48	412

The ¼ and ½-hp alternating motors operate at 100 volts, all other alternating motors at 500 volts, as stated above.

Transformers for the operation of the alternating motors are mostly connected in banks to short distribution circuits. Besides the supply to motors, energy from the 2,400-volt alternating lines is taken transformers for lighting purposes, and by still other transformers that yield 10,000 to 50,000 volts for the purposes of testing insulation.

The largest building of the works, in which all the heavy pieces of apparatus are machined and assembled, occupies a ground area of 90 ft. x 500 ft. The part of this building which has the lesser total elevation, occupying a ground area of 30 ft. x 500 ft. contains a main



LARGE VERTICAL BORING MILL AND VIEW OF ONE OF THE AISLES IN STANLEY ELECTRIC MANUFACTURING COMPANY'S WORKS.

floor and gallery of equal dimensions, where the lighter parts of the machine work is done. The higher part of this main building, with an elevation corresponding to three stories, has a perfectly clear space from floor to roof trusses, as may be seen in the illustration. This clear space is well lighted by a skylight that extends along story. A ground area 60 ft. x 500 ft., with a clear space above it the entire length of the roof, and by side windows in the third three stories in height, is thus provided for the heavy work. Two cranes driven by electric motors sweep this entire space of 60 ft. x 500 ft. One of these cranes has a capacity of 15 tons and the other of 30 tons, so that parts of the largest generators are readily transported between any points on the main floor. Branch tracks from the railway enter one end of this main shop, and a pneumatic hoist, mounted on a special car, moves on these tracks and is used for loading and unloading machinery and supplies. On the floor of this main shop are many machine tools, interesting because of their size or special features, but space here permits particular notice of only one of them, a large vertical boring mill, built by the Stanley company for its own use, and illustrated herewith. This mill is driven by an electric motor, connected through gears, and can be operated either with revolving work and stationary tools or with revolving tools and stationary work. The illustration shows the mill arranged on the latter plan, where it has a boring capacity of 32 ft. diameter. When the work is mounted on the revolving center-table the mill bores or turns to a diameter of 21 feet. On this mill the inductor spiders and circular armature frames of the largest generators are turned and bored. This mill also has a drilling attachment at each end so that the large work can be both turned and drilled at a single setting.

Along one side of the main machine shop are ranged a number of one-story buildings, opening into it, and covered with the saw-tooth type of roof. In these smaller buildings and in the gallery portion of the main section of the main shop, the smaller parts of machinery are manufactured and assembled, and the operations of winding are carried out. In the case of magnet coils for the large inductor generators, however, the head room of these smaller buildings is not sufficient to swing the spools, and these latter are therefore wound in the main shop. Two stories of a separate large brick building are devoted to pattern work, and the third story to arc lamps and instruments.

Some features of the winding work are worthy of especial mention. One point at once noted is the almost total absence of the time-honored methods of hand winding. Substantially, all of the winding for the Stanley apparatus is now done on forms or spools by machine power, and reaches its final form before it is ever applied to generators or transformers. Another important feature of both transformer and generator windings is the use of square wire and rectangular strips to the practical exclusion of round wire, except in the smallest sizes. As has long been understood, square wire makes it possible to put 25 to 30 per cent. more copper into a given space than can be done with round wire. During several years the somewhat greater difficulty of insulation with square wire operated as a great restriction to its use, but the Stanley company seems to have overcome this disadvantage and is able to enjoy the economies of manufacture incident to the use of square wire.

Other instructive features of the winding work may be noted in the methods of insulation. In many cases coils wound with heavy copper strips are left without any insulation whatever until completely formed, and thin strips of mica are then forced between the several layers of copper before tape is applied to the outside of the coils. The principal insulating materials applied to the windings of the Stanley apparatus are oiled cloth, card-board treated with insulating compounds, mica and micanite; besides, of course, paints and oils, in which the completed coils are dipped or thoroughly immersed. Coils not intended to be immersed in oil when operating are dipped into a bath of hot insulating compound when otherwise completed, and this compound is forced into the coils under pressure. Coils that are to be treated in the way just described are previously wound with dry tape, while coils intended for permanent immersion in oil are covered with strips of oilcloth.

In the Stanley apparatus, many of the stationary as well as the moving parts of generators and motors, besides the cores of transformers, are built up of thin iron stampings. The punching department of the works is, therefore, an important one, and contains a considerable number of presses. In spite of the very large dimensions of some of the generators, the tendency seems to be to cut the sheet-iron parts into sections of comparatively moderate size, and thus use dies of no great extent. Sheet-iron parts before they are assembled are treated with a coating of insulating compound.

An 80,000-volt Transformer.

The writer recalls a paper he read before his classmates in a technical college some fifteen years ago. It was based on Sir William Thomson's prediction that some time in the future Niagara's power would be distributed over great distances by means of alternating current at 40,000 volts. There has recently been built and installed by the General Electric Company transformers to be operated at just twice that voltage which, fifteen years ago, was looked at as a possibility perhaps in the next generation, but scarcely in this.

In December last the General Electric Company was asked by the local lighting and power company in Butte, Mont., to submit a bid on a transformer to enable them to utilize 1200 hp at 80,000 volts

80,000-VOLT TRANSFORMER.

from the Madison River Power Company. While the company stated that they did not consider it the best of engineering to use so high a voltage for a transmission of only about 60 miles, it was quite willing to undertake the work and promised to deliver the transformers in fourteen weeks; an exceedingly short time considering their size (330 kw.) and a great advantage in voltage over commercial transformers previously built. The work was accomplished, however, substantially in the promised time and without an evidence of any weakness in the design as originally laid out.

In general the design closely follows the standard oil immersed

water-cooled transformer built by the General Electric Company and except for allowance for the increased voltage, is identical with that of the 500 kw. transformers built by it for the Bay Counties transmission in California, which have now been in continuous operation for over a year at 60,000 volts.

The coils of which the winding is composed are wound with flat copper strip and are remarkably strong and rigid considering the small conductors that must be used for such small high voltage units. They are covered with only sufficient waterproof insulation to exclude any moisture that might be deposited on them during transportation. The heat generated in the winding can therefore escape as easily as from the coils of a low-voltage transformer.

Oil, specially refined for this high-voltage work, is relied upon mostly for insulation. The spaces between the high voltage coil and all other parts, however, are sub-divided into separate ducts by diaphragms of solid insulation, so that any conducting particle that by accident might fall into the oil can bridge but a small percentage of the oil space. This construction, it will be seen, also subdivides the solid insulation into thin layers so that any heat that might be generated in it due to dielectric hysteresis is promptly dissipated by the free-moving oil in the ducts.

The transformer case and cover including all bushings and cables are made with air-tight joints. Previous to filling the transformer with oil it is exhausted of all air with a vacuum pump and the winding heated to expel any moisture that might be on the coil surfaces. While in this vacuous condition, oil specially treated to expel all foreign particles, air or moisture, is allowed to flow into the transformer from the oil treating tank, this method of filling being repeated when the transformers are started in commercial operation.

By the use of these novel methods, the insulating quality of commercial oil, is so improved as to require much less thickness of oil to withstand these high voltages than would otherwise be the case. Reduction in transformer costs and improvement in its constants are the natural results.

Tests showed the following performance at 60 cycles:

Efficiency	97.5 per cent.
Regulation	1 "
Reactance	4 "
Heating by resistance	30 deg. C.

When the small capacity and high voltage are considered, also the fact that the greatest reliability rather than extreme efficiency, etc., was especially aimed at, these figures prove that 80,000-volt transformers are an assured commercial success. The test included an insulation test at double voltage, *i. e.*, 160,000 volts, which failed to develop any weakness.

To determine the possible presence of losses due to dielectric hysteresis or actual leakage through the oil or other insulation at this very high voltage, transformers were excited to double their normal voltage on the low potential side. The losses were then measured with the high potential windings separated into several sections so that the maximum voltage generated was so low that no such losses could take place. The high potential windings were then connected in series and the losses again measured. They were found to be identical with those first observed, indicating the entire absence of any such losses.

From the cut it will be seen that the terminal cables have soft rubber disks projecting from them. These were necessary in order to break up the static discharge that took place over the surface of the insulations when the transformer was under a strain of 160,000 volts between winding and ground. The insulation on these cables was ample to withstand this strain, but the static charge on the surface was so heavy as to reduce the effective length of the insulation to but a small fraction of the actual length. The test potential would cause an arc to form between the uninsulated end of a cable five or six feet in length and the transformer tank, before the soft rubber disks were added. The rubber was so molded that it could be securely cemented on the insulated cable for a distance of an inch or more. The disk, therefore, served the purpose of breaking the continuity of the static discharge and prevented the short circuiting of the test voltage. At operating voltage there was no brush discharge whatever; consequently the disks were useful only in connection with the test.

These transformers have now been in continuous operation at Butte, Mont., for several months. Unforunately, however, the Madison River Power Company is not yet ready to deliver current at higher than 40,000 volts, so that the possibility of transmitting such voltages with the present methods of line construction has not been demonstrated " out in the open."

New Portable Testing Set.

Messrs. Queen & Company, of Philadelphia and New York, have just put on the market a new testing set, in which are embodied several features which they believe will prove of general interest and great advantage. The set is called the "Queen Decade Portable Testing Set," and is illustrated herewith. It consists of a Wheatstone bridge and rheostat, battery, galvanometer with shunt, current interrupter, telephone receiver, keys, switches, etc.

In one of the arms of the Wheatstone bridge, besides the coils of 1, 10, 100 and 1,000 ohms resistance, are included a standard condenser and a standard inductance coil. In the rheostat are four rows of coils—units, tens, hundreds and thousands—each row consisting of 10 coils, which are wound non-inductively and without capacity. To make all the common measurements it is necessary to use only six plugs, whereas in the testing sets quite generally in use at the present time 22 to 26 plugs must be employed. The possibility of variable plug contact has therefore been reduced to a minimum. Furthermore, in this plan of bridge, the value of the resistance is read off direct, instead of as in the other forms, where various coils are unplugged to cut them into circuit and where it is necessary to add up on the completion of the test in order to obtain the total resistance.

PORTABLE TESTING SET.

An extra amount of battery is provided, the set containing ten dry cells of special form, having high voltage and large current capacity. The galvanometer in the set is of the D'Arsonval pattern, of low resistance, and of such high sensibility that it can be used for insulation resistance measurements by the direct deflection method. It is provided with a shunt, having 1, 1-10 and 1-100 values, which is conveniently arranged immediately above it. There are also provided posts, enabling the use of an outside galvanometer and an outside battery if desired.

With the set is supplied a telephone receiver, which can be used in many cases in place of the galvanometer; in fact, the telephone receiver is used for the capacity, inductance and electrolytic measurements. In the lid of the testing set is mounted a small induction coil, which produces an alternating interrupted current, which is employed when inductance, capacity and electrolytic measurements are made.

As will be seen from the illustration, there is a small drawer in the front of the case, in which is placed the connecting cords, telephone receiver, together with screw-driver and a pair of pliers, etc., which are furnished with the set. The case is of polished mahogany, and the outside dimensions are approximately 12⅞ inches long by 8 inches deep by 7½ inches wide, and the weight is about 14 pounds.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Time money was dull, closing at 4 per cent. for 30 days to four months, and 4¼ @ 4½ per cent. for five and six months. The stock market was firm but dull, excessively narrow speculative conditions prevailing during the entire week. The inactivity seems to be the result of the uncertainty on the part of the financial public regarding the duration and effects of the coal miners' strike. There was a good deal of talk about the traction securities, based on actual and prospective increases in their earnings, but the support given to Brooklyn Rapid Transit failed to stimulate outside buying. It is understood that the floating supply of Metropolitan has decreased. The Detroit United Railway stock, which has been dormant hitherto, scored a rapid advance due to reports that the control of the property had been acquired by an Eastern syndicate. Brooklyn Rapid Transit closed at 66⅞, a net loss of ½ point, the number of sales being 54,095. Metropolitan Street Railway made a net gain of ⅜ point, closing at 148¾, the total sales being 9,385. General Electric made a net gain of 5 points, closing at 320 on sales of only 500 shares. Westinghouse, common, closed at the highest price of the week, 214, which is a net gain of 2 points over last week's quotation. A net loss of ½ point in Western Union is recorded, the closing price being 90¼; and American Telephone and Telegraph closed at 173, being a net loss of 7 points. Amalgamated copper was heavy owing to less favorable accounts of the copper trade situation. The United States Steel stocks were also heavy in sympathy with the general tendency of the market. In outside securities the sales of stock during the week were less than 25,000 shares. The heaviest trading was in San Francisco Street Railway issues, which closed at 64, being a net loss of 1⅞ points. There was some business in General Carriage and Electric Vehicle. Following are the closing quotations of June 10:

NEW YORK.

	June 2.	June 10.		June 2.	June 10.
American Tel. & Cable.	87	87	Gen. Carriage (n. st'k).	4¾	4⅝
American Tel. & Tel.	176	174½	Hudson River Tel.	—	103
American Dist. Tel.	37	35½	Metropolitan St. Ry.	150	149
Brooklyn Rapid Transit.	68	67¼	N. E. Elec. Veh. Trns.	—	—
Commercial Cable	169	160	N. Y. E. V. T. Co.	13¼	13
Electric Boat	30	30	N. Y. & N. J. Tel.	—	166
Electric Boat pfd	47	45	Tel. & Tel. Co. Am.	—	—
Electric Lead Reduc'n.	3¼	2¾	Western Union Tel.	90⅛	90¾
Electric Vehicle	7	6½	West. E. & M. Co.	208	211½
Electric Vehicle pfd	14	13½	West. E. & M. Co. pfd.	210	210
General Electric	321½	317½			

BOSTON.

	June 2.	June 10.		June 2.	June 10.
American Tel. & Tel.	175	174	Mexican Telephone	2¼	2¼
Cumberland Telephone	—	—	New Eng. Telephone	147	149
Edison Elec. Illum.	—	—	Westinghouse Elec	—	—
Erie Telephone	—	—	Westinghouse Elec. pfd.	—	—
General Electric pfd.	—	—			

PHILADELPHIA.

	June 2.	June 10.		June 2.	June 10.
American Railways	45	45¼	Phila. Traction	97	97¼
Elec. Storage Battery.	89	88	Phila. Electric	5¼	5⅛
Elec. Storage Bat'y pfd.	88½	88	Pa. Elec. Vehicle	1¼	1¼
Elec. Co. of America	7⅛	7¼	Pa. Elec. Vehicle pfd.	3	3

CHICAGO.

	June 2.	June 10.		June 2.	June 10.
Cenrtal Union Tel.	—	87½	National Carbon pfd.	93	94
Chicago Edison	179½	—	Northwest Elev. com.	37¼	37¼
Chicago City Ry.	205	210	Union Traction	18⅝	18½
Chicago Teleph. Co.	170	—	Union Traction pfd	52½	52½
National Carbon	24	24¼			

DIVIDENDS.—The directors of Detroit United Railway have declared the regular quarterly dividend of 1 per cent., payable July 1. Twin City Rapid Transit directors have declared a quarterly dividend of 1¾ per cent. on the preferred stock, payable July 1. The directors of the Commercial Cable Company have declared the regular quarterly dividend of 1¾ per cent., payable July 1. General Electric directors have declared the regular quarerly dividend of 2 per cent. on the common stock. The directors have also declared a 66⅔ per cent. stock dividend. It is understood that details of the distribution will shortly be announced. At 320 for the present stock, General Electric new stock works out at 192. It is understood that at least 8 per cent. will be paid in dividends on the enlarged stock, and it is thought that this rate of distribution may be eventually increased to 10 per cent. The Westinghouse Electric and Manufacturing Company has declared the quarterly dividend of 1¾ per cent. upon the preferred stock, payable July 1, 1902. During this week Manhattan directors have declared the regular quarterly dividend of 1 per cent. The executive committee of Western Union has recommended the declaration of the regular quarterly dividend of 1¼ per cent. Otis Elevator directors declared the regular quarterly dividend of 1½ per cent. on the preferred stock.

LIGHTING DEAL IN BALTIMORE.—With a view to controlling the gas and electric light, heat and power of Baltimore, a movement is on foot to combine the Consolidated Gas Company and the United Electric Light and Power Company. The New York accounting and gas expert firm of Humphreys & Glasgow have been employed by a syndicate to make an examination of the Consolidated Gas Company. This syndicate is composed of Baltimore capitalists who have lately been heavy purchasers of the stock of this company. Among the purchases made were the shares held by Henry R. Wilson and Frank Tilford, the New York directors of the company, who recently retired from the board. Several Baltimore banking houses, including Townsend, Scott & Son, are interested. The syndicate is said to have bought from 15,000 to 20,000 shares of the company's stock, and to control a great deal more. The same syndicate is effecting operations in the stock of the electric light company. It is believed that the interests seeking control are connected with the Susquehanna Light and Power Company, which is constructing a big plant for utilizing the Susquehanna River.

BROOKLYN TROLLEY MERGER.—With the merging of the entire trolley systems in Queens and Nassau counties under one head, new articles of incorporation of the New York and Queens County Railroad Company have been filed with the Secretary of State. By this merger the new company takes into its control the entire plant and franchises of the New York and Queens County, the Queens Railway Company, and the New York and North Shore Railroad, which gives the combined trolley system several hundred miles of track, extending as far as Far Rockaway, in Queens, and out into Nassau County. The capital stock of the new company is set at $5,000,000. It is said the merging of the trolley roads is part of the McDonald-Belmont plan to obtain possession of the abandoned tunnel in Fourth Street, Long Island City, which has a franchise to run under the East River and connect the Long Island trolley system with the rapid transit system of Manhattan by means of this proposed tunnel.

OTIS ELEVATOR IN CANADA.—It is understood that the Otis Elevator Company has decided to form two sub-companies in Canada. The American company has been practically barred out of Canada, as far as trade is concerned, by the high duty imposed by the Canadian Government, and now proposes to equip plants in Canada for the manufacture of Canadian raw material under the Otis Elevator patents, which cover both the United States and Canada. The factory of the Leitch & Turnbull Company, Ltd., of Hamilton, Ontario, has been purchased, and the company incorporated in that city under the name of Otis Elevator Company of Hamilton. Negotiations are under way for the purchase of another plant in Montreal, and this company will be called Otis Elevator Company of Canada. The parent company will hold 51 per cent. of the stock of each company, and the majority of the remaining 49 per cent. will be held in Canada.

GENERAL ELECTRIC STOCK RESTORATION.—At a meeting of the directors of the General Electric Company last week, they not only declared the regular quarterly dividend of 2 per cent. on the stock, but also a stock dividend of 66⅔ per cent. The stock dividend, however, had been expected, as it had been announced that there would be an increase in the capital stock by a stock dividend. This will increase the capital stock of the company from $25,242,200 to $45,000,000, restoring the 40 per cent. stock surrendered in 1898. The dividend is payable July 15 to holders of record June 25. In anticipation of this stock dividend, General Electric stock has in the last year advanced materially, selling as high as 334 April 9 last.

ALLIS-CHALMERS ANNUAL REPORT.—The first annual report of the Allis-Chalmers Company, which was incorporated under New Jersey laws on May 7, 1901, has been issued. It covers the operations of the company from the beginning of business up to the close of the fiscal year, April 30. It shows: Net profits, after deducting all expenses of manufacture and selling, and after making full provision for depreciation of buildings, plant and machinery, and for possible bad debts, $1,442,260; dividends on preferred stock, $1,137,500; surplus, $304,760. The balance sheet as of April 30 shows: Assets—Real estate, good will, etc., $27,352,082; bills and accounts receivable, $2,778,721; stocks of merchandise, materials and work in progress (at cost), $3,333,665; cash, $4,514,167; total, $37,978,635. Liabilities—Capital stock, pre-

ferred, $16,250,000; common, $20,000,000; accounts payable, $1,139,500; dividend No. 4, paid May 1, 1902, $284,375; surplus profits for period, $1,442,260; less dividends on preferred stock, $1,137,500; total, $37,978,635. President Charles Allis in his report says: The manufacturing operations of the company during the past year have been marked by a demand for the products of the company greatly in excess of the capacity of the works even when operated under the most favorable conditions. The operations of the various works the past year have been greatly hampered and the output seriously restricted owing to the changes necessarily incidental to the consolidation of such large business interests, and to the prolonged strike of some of the workmen, the effects of which are still felt at several of the plants. The company has no floating debt. It has cash in bank amounting to $4,514,167, and in addition in excess of current liabilities it has net current quick assets of $4,688,511, making total cash and net cash assets of $9,202,678. The orders unfinished and in hand on April 30, 1902, amounted to $8,157,035; orders on hand and turned over to this company upon its commencement of business amounting to $5,665,882, showing a gain in the volume of business for the year of $2,491,153. The amount of work available is much in excess of present facilities, and these will be gradually and largely increased during the present year as the new works at West Allis approach completion. We believe, therefore, that the prospects of this company for the current year are most satisfactory.

THE STANLEY-WHITNEY DEAL, reports of which have been current for some time, have again been renewed, with confirmation, this week. The New York *Tribune* says: "The acquirement of a large interest in the Stanley Electric Manufacturing Company by men who control the traction companies of New York and Philadelphia and the building up of an enormous electrical business in competition with that of the General Electric Company and the Westinghouse Electric and Manufacturing Company will attract the attention of the financial world. It was ascertained by the *Tribune* yesterday that the control of the Stanley company had been taken over by William C. Whitney, Thomas F. Ryan, Thomas Dolan, William L. Elkins and P. A. B. Widener, and that the company's plant at Pittsfield, Mass., was to be increased to about six times its present size within a few months. Mr. Whitney and Mr. Ryan went to Pittsfield on May 1 and inspected the plant there, to see if it could be extended sufficiently to manufacture all the electrical supplies needed by the companies which they and their associates in Philadelphia control. They were accompanied on the tour of inspection by Harry Payne Whitney and by H. H. Vreeland and M. G. Starrett, president and chief engineer, respectively, of the Metropolitan Street Railway Company. They were received by Dr. Perrine, and conducted through the plant, and they looked over the site for the proposed extension of the plant. Arrangements for the acquirement of an interest in the Stanley company, for an extension of the Pittsfield plant and for the manufacture of the electrical supplies needed by the companies controlled by Mr. Whitney and his associates were made quietly since the inspection of the plant. Work on new buildings for the plant is already in progress. It is expected that before the end of the summer the capacity of the plant will be increased sixfold. Dr. Perrine is to be retained as the president of the company, and the Roeblings still keep an interest." The Stanley capital stock was recently increased to $3,000,000, when the Whitney pool, it is understood, took the new $1,000,000.

MONTREAL LIGHT, HEAT AND POWER.—The first annual report of the Montreal Light, Heat and Power Company was submitted at the recent annual meeting of the shareholders of the company. The gross revenue of the company amounted to $1,760,285, and the net profits to $729,721, being 5 per cent. on the capital on which the company had to pay dividends during the year. Out of the net profits there has been declared four quarterly dividends of 1 per cent. each, amounting to $587,968, leaving a balance of $141,753, which has been placed to the credit of surplus account. At a meeting of the shareholders, held on the 15th of January last, an issue of $7,500,000 of first mortgage bonds was authorized. Of this amount, $2,500,000 has been sold to take up $2,000,000 of outstanding bonds of the Montreal & St. Lawrence Power Company, and to provide for the present requirements of the company. A further amount of $1,405,000 is held in escrow to redeem the outstanding bonds of like amount of the Montreal Gas Company and the Royal Electric Company, leaving $3,595,000 of bonds in the treasury for the further requirements of the company. The old members of the board of directors were unanimously elected. The president, Mr. S. H. Holt, stated that in order to list the stock on the New York Exchange, it would be necessary to amend one of the existing by-laws of the company, which prevented anyone indebted to the company from transferring his shares. For instance, a shareholder owing a month's gas or electric light bill could not transfer shares. The listing committee of the New York Stock Exchange objected to the clause, and it was, therefore, removed with the full consent of the meeting.

NEW BELL TELEPHONE STOCK.—The American Telephone and Telegraph Company has voted an increase of capital stock, on the basis of one new share for each four shares outstanding, and as the new issue is $21,937,000, it follows that the present outstanding capital in the hands of the public is four times this amount, or $87,748,000. As this compares with an outstanding capital in the hands of the public of $28,836,300 at the close of the last fiscal year, it confirms the report that the company had sold about $5,000,000 of American Telephone stock to New York banking interests about three months ago, at $150 per share. As it is understood that the entire outstanding stock will aggregate about $136,000,000 after the settlement of the new subscription, which, of course, includes the amount held in the treasury of the old American Bell Telephone Company, and as the present stock with the new subscription will make $109,685,000, it is held to be clear that there can no longer be $32,110,200 stock in the treasury of the American Bell Telephone Company. For if this was the case the total stock would be $141,795,000. It is, therefore, clear that the sale to the New York bankers must have been from $32,110,200 of stock which was in the Bell Company's treasury.

HAVANA ELECTRIC BONDS.—Edward Sweet & Co. announce they they are authorized by the Havana Electric Railway Company to receive subscriptions until the close of business, on June 16, for $7,500,000 of the 5 per cent. consolidated mortgage fifty-year gold bonds of that company. These bonds are part of an issue of $10,000,000, the remaining $2,500,000 remaining in the treasury for future expenditures on capital account. The bonds now offered are to be used first to take up $5,000,000 of first mortgage bonds, $768,000 of second mortgage bonds, and $582,000 of coupon notes. The balance of the proceeds will be used to pay the floating debt, for extensions and acquisition of new property. Subscribers to the bonds must pay $125 on each bond upon application, $250 on allotment, and the remaining $605 on July 10. There is a simultaneous offering of the bonds in Montreal and London. The issue is redeemable either in whole or in part at 105, at the option of the company, on Feb. 1, 1907, or on Feb. 1 or August 1 thereafter, on giving six months' previous notice.

NIAGARA FALLS POWER COMPANY.—The Niagara Falls Power Company has certified to the Secretary of State, at Albany, that it has increased its capital stock from $6,500,000 to $9,500,000. The proportion of the capital actually issued is $3,331,000.

ELECTRIC COMPANY OF AMERICA.—The capital stock of Electric Company of America has been reduced from $25,000,000 to $5,000,000, and the par value from $50 to $10.

Commercial Intelligence.

THE WEEK IN TRADE.—A very satisfactory report of trade conditions is given by Bradstreet's, which states that crop prospects, taken as a whole, are really brilliant, railroad earnings are enormous despite the small grain tonnage, bank clearings are quite heavy notwithstanding the speculative dealings, and failures are fewer in number than in recently preceding years. The ending of the Boer war, it is also thought, will have a tendency to stimulate export business in manufactures. On the other hand, the industrial situation, though improved by the ending of the blast furnace strikes, is still a depressing one, owing to the prospect of the anthracite coal strike proving a long and bitter one, and the general unrest noted among workers in a number of industries. The feature in the steel trade is the conservative action of producers, who have fixed the price of steel rails for next year at $28, this being partly caused by the carrying over of large orders, delivery of which is impossible this year. A large volume of new business is also reported in this line. Business failures for the week, as reported by Brodstreet's, numbered 153 as against 163 the week previous and 163 the same week last year. The copper market was quiet but firm at the following quotations: Lake 12½@12⅝c.; electrolytic in cakes, wire bars and ingots 12½@12¼c.; cathodes 11⅞@12c.; casting stock 12¼c.

POWER FROM FEATHER RIVER.—Articles of incorporation have been filed in California of the Feather River Power Company, with a capital stock of $5,000,000. The company has been formed by Charles Webb Howard and other capitalists for the transmission of electricity from the Big Bend tunnel, on the Feather River, to San Francisco. The tunnel was built in 1882 by the Big Bend Tunnel and Mining Company at a cost of $1,500,000. The mining company has disposed of its interests to the new power company, but the terms of the transaction are not made public. The figure is in the neighborhood of several millions. At a point twenty miles above the town of Oroville the north fork of the Feather river makes a bend fourteen miles in length, which is called

the big bend. Beginning at that point the Big Bend Tunnel and Mining Company drove a tunnel through the mountain. The tunnel is 12,007 feet in length, the largest in the State. At the point where the tunnel emerges there is a fall of 450 feet to the river. It is this fall that will be utilized for generating electricity. The water is diverted into the tunnel by means of a great head dam, and its flow is controlled by massive gates, with stone concrete foundations. Power can be generated throughout the year, as even in the driest season there is a flow of 60,000 inches of water through the tunnel. There are no resevoirs connected with the system and no ditches that can be washed out by heavy rains. The officers of the new company are: President, Charles Webb Howard; vice-president, C. L. Fair; directors, W. J. Dingee, Charles Webb Howard, J. Downey Harvey, C. L. Fair and Frank McLaughlin. The installing of a power plant and the building of a distributing system will be begun by the company at once. At first all the power will be sold to San Francisco consumers. There is now 80,000 horse-power sold in that city and the demand is constantly increasing. The promoters of the new company believe that there is more than enough room for itself and the Bay Counties and Standard companies. They look forward to the building of a transcontinental railway line near their plant, and in that event will sell their power to the railway company. At present several trunk lines are at work surveying there.

THE MARINE ENGINE & MACHINE COMPANY, of Harrison, N. J., whose New York offices are in the Townsend Building, No. 1123 Broadway, which concern has been manufacturing electric elevators for the past two years, have made arrangements by which they have secured the sole agency for the sale of the hydraulic type of elevators built by the Portland Company, of Portland, Me. The original plunger type was first installed by the Portland people prior to the year 1850. The Marine Company has completed the erection of an extensive foundry adjacent to its elevator shops, where iron castings of every description are made. Being on tidewater castings can be made and finished of a larger size than would permit of transportation by rail. The company has also the Bournonville acetylene generators, which were formerly manufactured by the General Acetylene Company. The arrangement with the Portland Company was brought about by Mr. F. S. Hastings and Mr. Charles A. Benton, the general sales agent of the Marine Company, and Mr. R. C. Payson, treasurer of the Portland Company. Recent contracts secured by the Marine Company for electric elevators include two special self-oiling elevators for installation in the new Knox Building at Fortieth Street and Fifth Avenue. These elevators have a speed of 300 feet per minute. They are unique inasmuch that there is not a single key or pin used in the construction of the entire machines. A full automatic control elevator with a speed of 100 feet a minute has been ordered for installation in the residence of Mr. B. A. Williams, Fifth Avenue, New York.

OUR TRADE WITH JAPAN.—The "Annual Returns of the Foreign Trade of the Empire of Japan," for the year 1901 has just been received by the Treasury Bureau of Statistics. It shows that the United States which in 1881 furnished less than 6 per cent. of the imports of Japan, supplied 17 per cent. of those imports in 1901. The following table shows the increase by some of the more important articles in the importations of Japan from the United States, comparing 1901 with 1896:

Articles Imported.	1896 Yen.	1901 Yen.
Electric light apparatus	272,184	375,521
Fire engines and pumps	24,434	148,292
Farmers' and mechanics' tools	83,393	128,696
Locomotive engines	416,106	783,356
Paper-making machinery	123,520	251,942
Rails, iron	374,910	997,825
Iron pipes and tubes	73,941	541,049
Iron nails	232,319	668,490
Lubricating oil	192,624	278,626
Submarine cables and underground telegraphs.	none	167,536

TROLLEY COMPETITION WITH STEAM.—Reductions in suburban fares are being planned by the New York Central management of the Boston and Albany to involve the introduction of the zone system. The line between Boston and South Framingham will probably be divided into five five-cent fare zones, the total fare to be 25 cents, against the present fare of 50 cents. The primary cause is trolley competition. As far as South Framingham there are five lines directly competing with the steam road—the Boston Elevated, Boston & Newton, Newton Street Ry., Natick & Cochituate and South Middlesex. All have developed a thriving interurban business, which has been largely at the Albany's expense. The prospective competition is that of the Boston & Worcester Street Railway.

ENGINES FOR N. Y. EDISON WATERSIDE STATION.—Westinghouse, Church, Kerr & Company have received orders for two 6,500-hp Westinghouse-Corliss, compound condensing engines of the Waterside type, for the New York Edison Company. These engines will be installed in the Waterside station, making the equipment of the plant ten engines, aggregating 65,000-hp capacity, with a maximum output of 100,000 hp. The installation of the original order of eight engines is nearing completion, but the constant increase in the demand for electric power has been so great that the company has found it advisable to place this additional order and thus ensure an early installation of the additional equipment. As the new engines will be duplicates of those already installed, the work of construction at the Pittsburg shops of the Westinghouse Machine Company will be commenced immediately.

THE EAGLE-SHAWMUT MINING COMPANY, of Chinese, Calif., is installing a 200-hp air compressor plant, to be operated by an eight-foot steel disc Pelton water wheel; this wheel is to operate under a 900 ft. head, and will run at a speed of 100 r. p. m. The Pelton Company has had a great deal of experience in installing wheels for this class of work. One of unusual interest, and embracing some new and interesting features in hydraulic engineering, was recently installed at the Morning Mine, Mullan, Idaho. The wheel is 33 ft. in diameter—being the largest impulse wheel ever built—and weighs 33,000 pounds; this wheel operates under 1,400 ft. head and is direct connected to two 1,000-hp air compressors which run at a speed of 80 r. p. m.

POWER PLANT AT SEATTLE.—The Mutual Light & Heat Company, Seattle, Wash., is building a new power house, 65x75 feet, equipped with Babcock & Wilcox boilers of 600 hp., complete with chain grate stokers and superheaters, Green economizers, Sturtevant induced draft apparatus and Foster fan engine regulator. The plans comprehend four similar batteries when all is complete, with hopper storage overhead for 300 tons of coal, served through Clark's coal weighing device. The electrical equipment comprises two Alfree direct connected engines, with 60 kw. generators, and one Ideal engine belted to two 35 kw. generators. Charles E. Crane, formerly of Crane Bros. & Co., Yazoo City, Miss., is president.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, has recently closed a contract with the Greenfield and Turner's Fall Street Railway Company for the installation of a battery of chloride accumulators. This battery consisting of 200 cells, having a capacity of 200 amperes for one hour with tanks sufficiently large to allow of a 40 per cent. increase, will be placed in the new car houses at Cheapside, a distance of ten miles from the power house. The battery floating on the line is to be used at this point to regulate the drop in voltage due to the heavy grade which occurs near this station at the terminus of the railway company's line.

NEW STATION AT NASHVILLE, TENN.—The new power plant of the Cumberland Electric Light & Power Company, Nashville, Tenn., includes two International Power Company engines; one is to drive a 1600 kw. generator and the other is to drive a 1250 kw. generator; both furnished by the General Electric Company. The plant will also include a steam equipment consisting of two double-deck vertical header boilers, each boiler to be 350 hp. The company will also purchase a 50-ton, 56-foot span, hand power traveling crane. E. C. Hathaway is the consulting engineer and H. T. Brown the electrical engineer.

BULLOCK APPARATUS FOR SHAWINIGAN.—The Shawinigan Water & Power Company, of Quebec, has closed a contract with the Bullock Electric Company, of Cincinnati, Ohio, for the machinery necessary to complete the plant for service in Montreal. The machinery contracted for includes a set of motor-generators, which will be used to generate current at 2,000 volts. Mr. R. D. Mershon, of New York, will have charge of the construction work, and it is expected that the Shawinigan Company will be ready to deliver power in Montreal by the first of December next.

BULLOCK MOTOR-GENERATORS.—The Redlands Street Railway Company recently closed a contract through the Wagner-Bullock agency in San Francisco for a 200 kw. Bullock motor generator. It will be operated on a 11,000-volt circuit. A similar motor generator was recently started up by the San Bernardino Traction Company, San Bernardino, Calif.

ELECTRICAL EQUIPMENT FOR BATTLESHIP.—The Thresher Electric Company, of Dayton, Ohio, has the contract for equipping the battleship "Virginia" with electrical apparatus. Its bid was $105,000.

WATER POWER DEVELOPMENT.—Charters have been issued to nine new water and power companies, capital $300 each, to operate in York and Lancaster counties, to utilize the waters of the Susquehanna river for commercial purposes.

BALL ENGINES.—The Pittsburg Reduction Company, Pittsburg, Pa., has recently purchased from the Ball Engine Company, Erie, Pa., a 325-hp engine direct-connected to 200-kw generator, being a duplicate of an outfit installed a year ago.

General News.

THE TELEPHONE.

PEORIA, ILL.—The Interstate Telephone and Telegraph Company will establish a new system here.

NASHVILLE, ILL.—The Southern Union Telephone Comany will extend its lines throughout Washington County.

CHICAGO, ILL.—The United Telephone, Telegraph & Electric Company, which has operated a small exchange in Hyde Park for a number of years, has applied for a franchise to build all over the city of Chicago.

CHICAGO, ILL.—A telegram from Chicago of June 7, says: Recriminations and charges of betrayed promises flew back and forth in the City Hall to-day over the action of the City Council's Judiciary Committee yesterday in giving the Illinois Telephone and Telegraph Company all it wanted in the amendatory ordinances asked by the company. Rumors of bribery were rife, and a determination was expressed to make the vote on the motion to pass the ordinances the first test of the integrity of the new Council. By some aldermen the proposed ordinances are characterized as the biggest "thing" which has been attempted to be put through the Council since the fifty-year street railway franchise. Mayor Harrison refused to say a word about the ordinances and carefully refrained from saying whether he would veto the ordinances if they go through in their present shape. A story was current in the City Hall that preceding the Judiciary Committee's meeting President Wheeler of the Telephone Company and his Aldermanic supporters held a conference in the finance room. Here the plan of outline was arranged.

INDIANAPOLIS, IND.—The Markle Telephone Company, of Markle, capital stock $6,000, has been incorporated. Directors: E. S. Fisher, F. E. Alshouse and Abraham May.

FT. WAYNE, IND.—The issue of $50,000 additional stock has been authorized by the directors of the National Telephone Company. The money is to be used for improvements north of Ft. Wayne.

INDIANAPOLIS, IND.—The Central Union Telephone Company is installing a new substation in the northern part of the city. A substantial brick building has been completed and in a few days the substation or exchange will be in operation.

SHIRLEY, IND.—The Shirley Telephone Company has been incorporated with $3,000 capital stock, to operate in Hancock and Henry counties. C. W. Boreslog, J. C. McClain and M. E. Wood are directors. The Frost Telephone Company, also of Hancock county, has been incorporated with $120 capital stock by J. C. Moore, E. E. Brooks, J. N. Glascock and N. G. Cleft.

INDIANAPOLIS, IND.—The Albany Telephone Company, capital stock $10,000, has been incorporated. Board of Directors: Wm. H. Murphy, E. L. Lewis, E. A. Zehner, E. E. Luzadder, A. M. Pollard, E. H. Runneals and C. J. Campbell. This company will operate telephone lines and exchanges in Randolph, Blackford, Wells, Delaware, Jay and Madison Counties.

MUNCIE, IND.—As a result of an investigation and examination of the cause of the poor telephone service complained of in this city during the last few weeks, local managers of the Central Union Telephone Company discovered that nearly 5,000 feet of lead cable have been practically destroyed by being pierced with bullets. The holes were caused by shots fired from Flobert rifles in the hands of boys and young men who were shooting at birds. The loss to the company will aggregate nearly $3,000.

BANGOR, ME.—The Unity Telephone Company has been organized with a capital of stock of $10,000.

PONTIAC, MICH.—With the completion of about 10 miles of line between Linden and Holly the Oakland County Telephone Company of this place will have connection with nearly all the independent companies in the State.

DETROIT, MICH.—The Co-operative Telephone Company has placed a contract with the International Construction Company, of Chicago, for a modern switchboard of 12,000-lines capacity. It will be of the multiple central energy type and will be built under the McCormick patents.

LIBERTY, MO.—The Liberty Telephone Company has been incorporated with a capital stock of $15,000. The incorporators are: Sam. H. Woodson, Jennie M. Woodson, Pascal Parker, Sallye Parker and others.

OMAHA, NEB.—The Newport and Mariaville Telephone Company, of Newport, Neb., has been incorporated with a capital stock of $1,500.

OMAHA, NEB.—The Newport and Mariaville Telephone Company, of tion to its present building to provide larger facilities to accommodate its growing business. The new structure will cost about $100,000. The company also proposes to establish a branch exchange in the western part of the city.

AFTON, N. Y.—The Glen Telephone Company has been organized here.

ITHACA, N. Y.—The local telephone system will be extended to Moravia.

NEW YORK, N. Y.—Plans have been filed with the Building Bureau for a new six-story telephone exchange with shops, 92x100 feet, to be built for the New York Telephone Company on West Seventeenth street. It will have a facade of brick trimmed with limestone, and will cost $300,000.

BROOKLYN, N. Y.—As it would cost about $36,000 in install fire alarm boxes in all the Brooklyn schools, it is proposed to equip every school in the borough with a telephone. This plan is favored by Commissioner Jonas, of the Committee on Supplies, and by other members of the Brooklyn Board of Education as an improvement on the fire-alarm box, and much cheaper.

NEW YORK, N. Y.—The New York Telephone Company's private branch exchange service will be installed in the Manhattan Hotel, the Holland House, the Hoffman, the Imperial and the Marlborough during the summer months. Contracts have been signed covering a total of 2202 long-distance telephones to be placed in the hotels named. A total of 6374 long-distance telephones, to be placed in hotels and apartment houses in the Borough of Manhattan have been contracted for since January 1, 1902.

ZANESVILLE, OHIO.—The Zanesville Telephone & Telegraph Company has added over 100 subscribers during the past few weeks.

BUCYRUS, OHIO.—The Bucyrus Telephone Company will establish an exchange at Sulphur Springs, where a good list of subscribers has been obtained.

BARTLETT, OHIO.—The People's Telephone Company has increased its capital from $2,000 to $5,000 to provide for improvements. C. C. King is president.

VANWERT, OHIO.—The Convoy Home Telephone Company has increased its capital stock from $3,000 to $10,000, to provide for improvements. L. W. Larber is president.

JACKSON, OHIO.—The Jackson County Telephone Company has increased its capital stock from $6,000 to $12,000, to provide for improvements. W. H. Heidderjohann is president.

MANCHESTER, OHIO.—The Manchester Telephone Company has been incorporated with $1,500 capital stock by R. C. Henderson, G. J. Nicholson, J. C. Henderson, F. W. Long and Charles M. Long.

GALION, OHIO.—The Galion Telephone Company, recently purchased by local people from the Everett-Moore Syndicate, has increased its capital stock from $30,000 to $100,000. Mark Cook is president.

SMITHFIELD, OHIO.—The Farmers' Independent Telephone Company has placed its system in operation in this place. Long distance connection is secured through an arrangement with the Harrison County Telephone Company, of Cadiz.

SEBRING, OHIO.—The Central Union Telephone Company is installing a local exchange, and all subscribers will be given the benefit of free service to Alliance and surrounding towns. The rates are $1 for residences and $2 for business houses per month.

WARRENSVILLE, OHIO.—The Warrensville Telephone Company has been incorporated with $5,000 capital stock by W. F. Kehres, E. C. Foote, J. N. Smith, F. A. Judson, Charles Haltz, A. L. Kehres and W. C. Teal. A system will be built in Warrensville, a suburb of Cleveland.

HASKINS, OHIO.—The Haskins Mutual Telephone Company has been organized with the following directors: F. A. Robertson, W. T. Moore, John Schutzenberg, Robert Pargellis, E. C. Thornton, J. A. Bower and Fred Dauer. The capital stock is $10,000. The company has twelve miles of line in operation, which are to be extended to Grand Rapids and Tontogany.

CLEVELAND, OHIO.—Semi-official announcement has been made by the Everett-Moore syndicate that in all probability the Federal Telephone Company will be retired from the boards. Of the 23 component organizations controlled by the Federal Company, 21 will be sold, leaving only the Cuyahoga Telephone Company, of Cleveland, and the United States Telephone Company (long distance) in the hands of the syndicate.

CANTON, OHIO.—The Stark County Telephone Company has elected directors as follows: Joseph Biechele, J. B. Hoge, Ferdinand Herbruch, Dr. T. H. Phillips, John C. Welty, R. S. Shields, H. D. Critchfield, A. Dannemiller and Henry A. Cavanah. The directors decided to push improvements at once. The company is installing a large addition to the switchboard at the local exchange. It has a large number of subscribers on the waiting list

NORWALK, OHIO.—The Norwalk Telephone Company has been organized with J. F. Laning, president; C. R. Callaghan, vice-president and general manager; Frank A. Knapp, secretary, and J. H. Beatty, treasurer. The above, with A. K. McConnell, D. Calhoun, Ford H. Lanning and W. M. Halliday, are directors. The company has absorbed exchanges at Norwalk, Milan, Monroeville, Chicago Junction, Plymouth, Greenwich, New London, Berlin Heights, New Washington, Crestline and other places. The united company has over 3,000 telephones in operation and 200 miles of toll line.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone phone Company will be extended to Eden, Weber County, Utah.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone Company has closed the gap between Casper and Douglas, Wyo. A branch line runs from Douglas to Cheyenne.

SALT LAKE CITY, UTAH.—The County Commissioners of Salt Lake County have granted a franchise to Reed Smool, Jesse Knight, C. E. Loose, George Havercamp and S. K. Thurman to construct an electric railway and telephone lines in the county.

MONTICELLO, WIS.—The Independent Telephone Company, of Waupaca, will build a line from that city to Almond, Plainfield and Hancock.

DARLINGTON, WIS.—The Wisconsin Telephone Company will extend its lines from Darlington to Argyle and Blanchardville.

MADISON, WIS.—The Westby Telephone Company has been incorporated with a capital stock of $3,000, by A. H. Dahl, W. J. Mitchell, A. Lee and H. Slevlinger.

MENOMONEE FALLS, WIS.—The Menomonee Falls Telephone Company has been incorporated to construct and operate telephone exchanges and toll lines in the counties of Milwaukee and Waukesha.

OTTAWA, ONT.—The mayor of Ottawa, Ont., is in receipt of numerous letters from telephone manufacturers and firms in the United States inquiring for particulars in regard to the tenders invited by the city council of Ottawa for an independent telephone system for the city, mention of which has been made in this column recently.

ELECTRIC LIGHT AND POWER.

MOBILE, ALA.—The general council of Mobile had a proposition from the Mobile Light & Railway Company to light the city on a ten-year contract for $50 a lamp per year.

BIRMINGHAM, ALA.—The city council has granted two franchises to James L. Tanner and associates, one of which is to build an electric lighting and power plant with wires underground. Western capital is interested.

PRESCOTT, ARIZ.—The Prescott Electric Light & Power Company will use a steam turbine to operate an electric generator. Chas. C. Moore & Company of San Francisco will furnish a 150-hp Babcock & Wilcox boiler—to carry 200 pounds of steam—and a superheater.

OXNARD, CALIF.—The Oxnard Suburban Electric Company has incorporated with a capital of $10,000. The directors are: D. T. Perkins, W. T. Wayte, M. V. Lockwood, S. Cohn, L. J. Rose, J. A. Driffil and P. S. Carr.

SAN FRANCISCO, CALIF.—The Vacaville Water & Light Company has been sold to E. D. N. Lehe, W. Z. McBride of Dixon, Calif., and F. R. Orella of San Francisco. The new management will distribute the current from the Bay Counties Power Company's transmission line. Dixon is lighted in the same way by Mr. Lehe and Suisun will soon have lights supplied from the Bay Counties system.

SAN FRANCISCO, CALIF.—Thos. Hill and Geo. Sparks of Redding, Calif., have filed water appropriations for 100,000 inches of water of the McCloud River in Shasta County. It is understood that these rights which had been held by a company had lapsed and that the new locators will transfer their rights to the McCloud River Electrical Power Company. H. C. Wybro will install the electric plant of this company.

SAN FRANCISCO, CALIF.—The San Antonio Water Company of Ontario, Calif., recently ordered an additional 3-phase General Electric 250-kw, 10,000-volt generator. The water company now controls the entire water supply of the San Antonio Canyon. It will do its own pumping by electricity but it is reported that nearly all of its electrical output will be sold to the San Gabriel Electric Company for distribution. A sub-station will be built at North Ontario.

SAN FRANCISCO, CALIF.—The Feather River Power Company which was recently incorporated in San Francisco with a capital stock of $5,000,000 will install an electric power plant about 20 miles above Oroville, at the Big Bend of the Feather River. A tunnel 12,007 feet in length was driven here by the Big Bend Tunnel and Mining Company and a dam constructed. The company has acquired all of that company's property and will build a power house near the outlet of the tunnel where there will be an available head of 450 feet. At least 20,000 hp will be transmitted to San Francisco. The estimated cost of the system is $2,000,000. Chas. Webb Howard is president of the company and Chas. L. Fair, vice-president.

HARTFORD, CONN.—A section of the dome of the State Capitol, in this city, is now electrically lighted. When the plans are completed there will be a total of 834 lights on the dome. Nernst lamps were used in illuminating the House of Representatives during the Constitutional Convention. When the wiring of the building is finished there will be a large chandelier under the dome with 1,500 electric lamps. The work is being carried out by the New England Engineering Company, of Waterbury, Conn.

GREENFIELD, MASS.—The Automatic Machine Company will operate its new factory with electric power.

SPRINGFIELD, MASS.—Smith & Wesson propose putting in a large electric power plant at Barrett's Junction, utilizing water power.

ZEELAND, MICH.—A proposition to issue $18,000 electric light and water works bonds has carried.

GRAND RAPIDS, MICH.—The Grand Rapids Edison Company has been organized under the laws of New Jersey to take over the properties of the Edison Electric Light Company and the Grand Rapids Electric Light & Power Company, recently purchased by Chicago and Cincinnati capitalists. The new company has $1,000,000 capital stock and $610,000 bonds.

MOBERLY, MO.—The Moberly Light, Power and Fuel Company has been incorporated with a capital stock of $2,500, one-half paid. The incorporators are J. H. Starr, W. M. Afflick, F. B. Miller, F. C. Jacoby, C. A. Thompson and others.

ST. LOUIS, MO.—The organization of the Union Electric Light & Power Company was perfected May 28 at a meeting at which Julius S. Walsh was elected president; Breckenridge Jones treasurer, and H. P. C. Coakes secretary and assistant treasurer. E. G. Bruckman was elected manager of the former Imperial plant and Chas. H. Ledlie, of the Citizens' Company, was made chief engineer of construction. The executive committee is composed of Julius S. Walsh, C. W. Wetmore, W. F. Nolker and W. F. White. New directors were elected to take the places of those elected temporarily at the last meeting of the parties interested in the consolidation, as follows: C. W. Wetmore, Geo. R. Sheldon and W. F. White, all of New York. C. W. Wetmore, vice-president of the combination, is president of the North American Company. Mr. Coakes, the secretary and assistant treasurer, has been secretary of the Imperial Company, of this city.

BINGHAMTON, N. Y.—The International Time Recording Company will operate an addition to its factory with motors.

AMSTERDAM, N. Y.—The Mohawk Mills are putting in a General Electric generator direct-connected to a Hooven, Owens & Rentschler engine, with three 170-hp Franklin water-tube boilers.

GOSHEN, N. Y.—The Goshen Light and Power Company will build a new boiler house and install a 150-hp boiler. The company will enlarge its main plant to make room for new electrical equipment.

ARCADIA, OHIO.—The village of Arcadia is considering a proposition for arc lights in the streets, current to be furnished by the Toledo, Fostoria & Findlay Electric Railway Company.

XENIA, OHIO.—H. C. Hubbell and C. C. Hubbell of this city have bought the electric light and power plant at Somerset, Ky. The plant supplies 40 arc lamps and 2000 incandescents. It is understood that new equipment will be installed.

COLUMBUS, OHIO.—Franchise ordinances of the Great Eastern Theatre & Light Company and the East Columbus Heating & Lighting Company have been recommended to the council for passage. Both concerns desire to operate lighting plants on the east side of the city.

HUDSON, OHIO.—Charles Backman of Akron has applied for a franchise to install an electric lighting plant in Hudson. He proposes to furnish arc lamps to the town at $50 per lamp per year, at least 20 to be used, and to furnish incandescent lamps at 50 cents for the first one, 45 cents for the second, 40 cents for the third, 35 cents for the fourth and down to 20 cents for six or more in one building. He also agrees to sell the plant to the town at the end of 10 years, if desired.

PORTLAND, ORE.—The Portland General Electric Company has ordered five 700-hp 3-phase generators for the power station at Oregon City, Ore. It is expected that the first machine will be in operation by Oct. 1. The water-wheels have been ordered in Dayton, Ohio. The present generating station will be extended as soon as there is low water in the river. Additional rotary converters and switchboards will be installed in a new distributing station that will be built in Portland adjoining the old one at 7th and Alder streets. It will be a fire-proof building 60x100 feet. About 40 carloads of machinery have been ordered and will be ready for use within one year. The Portland distributing system will be reconstructed and the voltage doubled on the main transmission line.

ANDERSON, S. C.—J. J. Fretwell, owner of the water power at Hatton's Ford and Tugaloo River, states that this power will be developed. There are from 6,000 to 10,000 horse power available at Hutton's Ford. It is proposed to build a large cotton mill on Tugaloo River. There is a possibility of bringing power to Anderson.

DYERSBURG, TENN., will receive bids until June 17 for the construction of water works and electric light systems. Plans and specifications may be had by addressing W. A. Fowlkes, Jr., Mayor.

SALT LAKE CITY, UTAH.—A new power and development company has been organized at Grant's Pass, Ore., to utilize the power from Applegate Falls for furnishing electric power to operate all the stamp mills and mining machinery and factories in Josephine County; also to furnish power for an electric railway from Grant's Pass to the Waldo copper district. H. W. Ogible, of San Francisco, is manager of the company.

WARRENTON, VA.—The Warrenton Electric Company has placed the contract for a complete electric lighting system.

INDEPENDENCE, WIS.—The village has voted to issue bonds for an electric lighting plant.

EAGLE RIVER, WIS.—The Eagle River Light and Water Company has been incorporated. The capital stock is $15,500 and the incorporators are: D. E. Riordan, J. K. Fish and F. J. Thorn.

OTTAWA, ONT.—The Soulanges Canal has been opened for the season with the new electrical apparatus for working the lock gates, sluices, bridges, etc., in full and successful operation. The canal is brilliantly lighted by electricity throughout, and is as easily navigable by night as in the daytime.

THE ELECTRIC RAILWAY.

MATTOON, ILLS.—The Mattoon Electric Railway Company has been granted a franchise to operate a street railway in this city. The company has been incorporated at Springfield for $100,000. The incorporators are Edgar A. Potter, Mattoon; S. W. Worth and Arthur Dyanforth, Chicago; Judge T. Grosscup of the Court of Appeals, Chicago, is said to be behind the project.

INDIANAPOLIS, IND.—The Richmond Street and Interurban Railway has increased its capital stock from $500,000 to $600,000.

EVANSVILLE, IND.—An electric railway from this city to Princeton is now practically assured. Ohio capitalists have taken up the project.

MADISON, IND.—The city council has granted a franchise to representatives of an Eastern syndicate for an interurban electric railway between Madison and other river towns.

INDIANAPOLIS, IND.—The Indianapolis, Lebanon & Frankfort Traction Company has signed its acceptance of a franchise to enter this city similar to that of the Union Traction Company.

INDIANAPOLIS, IND.—The Eastern Indiana Traction Company has filed notice of an amendment to its charter, to cover the construction of its road from Ridgeville, Jay County, to Gas City.

KOKOMO, IND.—Officials of the Toledo, St. Louis & Kansas City Railroad announce their purpose to purchase electric locomotives to haul standard cars and will inaugurate a half-hour service between this city and Marion.

INDIANAPOLIS, IND.—The North American Railroad Construction Company of Illinois has filed incorporation papers in this State. The capital used in this State is $10,000, and J. H. McCowen is the local representative. The company will build a number of electric railways.

LOUISVILLE, KY.—Tennis Bros. & Company, electric railway contractors, are considering a proposition to build a line from Louisville to Prospect.

PADUCAH, KY.—The Paducah City Railway Company has filed articles of incorporation with $300,000 capital stock. The stockholders are W. L. Hayes, Cleveland; A. L. Rich, C. S. Maltby, Cincinnati; C. Dullam, Louisville. The company will absorb the Paducah Street Railway & Light Company. A number of improvements will be made.

TRENTON, N. J.—The Easton & Washington Traction Company, of Phillipsburg, N. J., has been incorporated; capital stock, $100,000. Incorporators: Thos. A. H. Hay, Wm. O. Hay and Robert M. Petty.

CANTON, OHIO.—The county commissioners have granted a franchise through the county to the Massillon, Dalton & Wooster Railway Company.

COLUMBUS, OHIO.—The Columbus, Buckeye Lake & Newark Traction Company has changed $500,000 of its common stock to preferred stock. The company is capitalized at $1,500,000.

CANTON, OHIO.—The Canton-Massillon and the Canton-Akron companies are to be merged on June 17. Both properties are owned by Tucker, Anthony & Company, Boston. The line through Canton will be double-tracked.

AKRON, OHIO.—The Northern Ohio Traction Company is endeavoring to secure the lighting contract in Barberton. The company is making improvements to its lighting system, and is just installing an 1,800-hp Cooper-Corliss engine with Westinghouse generator.

CINCINNATI, OHIO.—The Cincinnati & Eastern Railway Company, the Suburban Traction Company and the Rapid Railway Company have organized a union station company, and have secured a tract of land on Sycamore street, where a union passenger and freight station will be built.

CONNEAUT, OHIO.—George L. Chapman, George Cleveland, J. Thomas and George Watson of Cleveland are securing right of way for an electric railway from Girard, Pa., to Albion, Shadeland, Springboro, Conneautville and Conneaut Lake. These people are promoting several lines radiating from Conneaut.

PIQUA, OHIO.—The Miami Valley Railway between Piqua and Troy has passed into the hands of the Dayton & Troy Electric Railway Company under a 99-year lease. The road will be overhauled and improved and cars will run through from Dayton to Piqua. The power house at Piqua will be abandoned and power will be furnished from the Dayton and Troy station at Tippecanoe.

FINDLAY, OHIO.—The Findlay, Kenton, Bellefontaine & Urbana Railway Company has been organized with Senator David Joy, president; J. M. Stein, vice-president; C. H. Thorndyke, secretary; W. J. Burget, treasurer. Directors: the above and J. N. Shaffer, J. DuVald, W. P. Wiseley, C. A. Bond, L. Monheimer and M. C. Shaffer. It is claimed that a greater part of the right of way has been secured.

YOUNGSTOWN, OHIO.—A consolidation of the Mahoning Valley Railway Company, the Trumbull Electric Company and the Mineral Ridge & Niles Electric Company was effected May 1 at meetings of the directors of the companies. The new company will be known as the Mahoning Valley Electric Railway Company, and the capital stock has been increased from $1,500,000 to $2,500,000 for the purpose of covering the cost of all the properties.

CLEVELAND, OHIO.—The deal for the purchase of the Everett-Moore holdings in the Detroit United Railway by an eastern syndicate has been declared off, the option having expired. There has also been a hitch in the transaction whereby Cleveland people were to take over the holdings in the Northern Ohio Traction Company. Under an arrangement with the Toledo & Monroe Railway, the Detroit & Toledo Shore Line is again operating cars from Toledo to Detroit.

RENTON, WASH.—A franchise has been granted to the Seattle & Renton Electric Railway Company.

SPARTA, WIS.—The Sparta-Melrose Traction, Light & Power Company has been incorporated with $25,000 capital.

MILWAUKEE, WIS.—The Milwaukee Electric Railway and Light Company has increased the wages of all motormen and conductors.

SHEBOYGAN, WIS.—John I. Beggs, general manager of the Milwaukee Electric Railway and Light Company, recently went over the entire street railway line with a view of ascertaining its value and whether the system was adaptable to his corporation purpose. It is reported that an electric line is to be built from Milwaukee to this city to connect with the local line.

TORONTO, ONT.—The Consolidated Electric Company, of Toronto, has been incorporated with a capital of $100,000. The provisional directors are: A. J. Phillips, G. C. Brown, A. H. Howarth and A. R. Riches, all of Toronto.

MONTREAL, QUE.—Messrs. S. H. Ewing, Alex. MacPherson, Murdoch Mackenzie, J. P. Cleghorn and James Tasker, of Montreal, have been incorporated by the Ontario government as the Cornwall Street Railway, Light & Power Company, with a share capital of $200,000.

THE AUTOMOBILE.

THE HALSEY AUTOMOBILE COMPANY of St. Louis has been incorporated with a capital stock of $30,000, all paid. The incorporators are: Oscar L. Halsey, Augustus C. Halsey, Edward J. Snowden.

AUTOMOBILES IN THE MARITIME PROVINCES.—An automobile company has been organized in Charlottetown, P. E. I. It is proposed to have an automobile service to the various summer resorts on the north side of the island.

THE AUTOMOBILE CLUB of St. Louis has applied to the Circuit Court for a pro forma decree of incorporation. The officers are: F. H. Walker, president; E. M. Senseney, secretary, and Edward Mallinckrodt, Jr., treasurer. The club will be governed by a board of directors, consisting of the officers and Jules F. Valle, George B. Leighton, A. Niedringhaus, John S. Carter, John Ring, Jr., and Horace Rumsey.

NEW INDUSTRIAL COMPANIES.

THE OHIO BRASS COMPANY, of Mansfield, Ohio, has been incorporated under the laws of New Jersey with $1,000,000 capital. Incorporators: Frank B. Black, Reid Carpenter, Charles N. King, Harry F. Black, George F. Lucas, and E. T. Cook, all of Mansfield.

THE KINSMAN ELECTRIC AND RAILWAY SUPPLY COMPANY of New York has been incorporated with a capital stock of $30,000. The directors are S. A. Wood, of New York; W. H. Van Arsdale, of Aurora, Ill., and F. E. Kinsman of Plainfield, N. J.

THE GOLD CAR HEATING AND LIGHTING COMPANY of New York City has been incorporated with a capital of $1,000,000. The directors are: Edward E. Gold, Richard Voges and John M. Scoble, of New York City; John F. Cahill, Edward J. Ronan, Christopher Moran and Lucius E. Varney of Brooklyn.

THE ELECTRICAL EQUIPMENT COMPANY is the name of the corporation recently formed in Chicago by J. Holt Gates, president; W. J. Peterson, vice-president and manager, and Arthur W. Tobin, secretary and treasurer, to carry on an engineering and contracting business for complete alternating and direct current electric light and power plants. The offices will be at 939 Monadnock Block, Chicago. The gentlemen forming this company are all too well known in the electrical trade to need introduction. They will undoubtedly obtain their share of business, since they have had long experience as selling agents and contractors.

LEGAL.

TELEPHONE LITIGATION.—The American Bell Telephone Co. has recently brought suits against the Cuyahoga Telephone Co., of Cleveland (with H. A. Everett, E. W. Moore, J. B. Hoge and R. H. Judd as defendants) and against the Pittsburg & Allegheny Telephone Co. for alleged infringements of telephone patents.

PERSONAL.

MR. RUSSELL BAKER has resigned his position as superintendent of the Electric & Water Company at Little Falls, Minn.

MR. FRANK B. RAE, the well known electrical engineer, announces the marriage of his daughter, Miss Lilia Alwilda Rae to Mr. Burt Barnes.

MR. W. J. HAMMER and family are going abroad this week, and will spend some time in England and on the Continent. Mr. Hammer has several electrical matters to look after.

MR. GEORGE HERBERT WINSLOW, consulting electrical engineer, Pittsburg, Pa., was married in Cleveland on June 4 to Miss Sarah Duncan, niece of the late President McKinley.

MR. GEORGE B. FRANCIS has resigned his position as chief engineer of the Providence, R. I., street railway system to accept one as civil engineer with Westinghouse, Church, Kerr & Co., of New York.

MR. BERT H. ELLIS, who has been president and manager of the Eastern Electrical Supply Company since its formation, has severed his connection with that concern, much to the regret of the company.

DR. A. W. DUFF, professor of physics of the Worcester Polytechnic Institute, gave as the annual commencement lecture before the Engineering Society a lecture on wireless telegraphy, the telegraphone and the telephone arc light.

MR. ISAAC L. RICE, president of the Consolidated Rubber Tire Company, has been elected to the recently created office of chairman of the Board of Directors, and as such will act in an advisory capacity to the officers of the company. Van H. Cartnell, who has been connected with the company for a number of years, has been elected president to succeed Mr. Rice.

MR. H. L. SHIPPY, of Roeblings, goes abroad and will be in England during the coronation. He has visited more British colonies than most Englishmen and has a wider electrical acquaintance around the globe than perhaps any other American commercial representative.

MR. W. M. PATTERSON, formerly of the ELECTRICAL WORLD AND ENGINEER, and more lately with the celebrated engraving and publishing firm of Bartlett & Co., was married on June 4 to Miss Clara Lyeth, at Nyack-on-Hudson. They will reside in Brooklyn after the honeymoon.

MR. JOHN W. MACKAY, of the Commercial Cable Company, who sailed on the Celtic last week, will go to Mrs. Mackey's London residence, Carlton Terrace, immediately after his arrival in England. Mrs. Mackay will entertain during the coronation festivities.

MR. W. J. JONES has resigned his position as engineer of the Gas & Electric Company of Bergen Co., N. J. (a description of the plant of which company Mr. Jones contributed to our issue of May 24), in order to accept charge of the Denver, Col., offices of the Stanley Electric Manufacturing Company.

MR. LEONARD WILSON, late of the Brush Elec. Eng. Co., of England, has recently arrived in this country and has now joined the engineering staff of the Stanley Elec. Mfg. Co, of Pittsfield, Mass. Mr. Wilson has had four or five years' experience in design and construction and expects to find abundant opportunity.

MR. H. W. B. BLOMQVIST, the electrician of Upper Montclair, N. J., has recently had the misfortune to lose his father, who was well known in real estate circles in New York City. Mr. Blomqvist was lately with the Metropolitan Street Railway Co., but is now intending to put up a private laboratory at his residence to develop some new ideas and inventions.

MR. CHARLES T. MALCOLMSON has received the appointment of superintendent of power and transmission exhibits at the St. Louis World's Fair. He goes direct to St. Louis from the Charleston Exposition, where he was chief of the bureau of power and lighting. At the Paris Exposition he was assistant director of machinery and electricity of the American section.

HON. CHANDOS S. STANHOPE, president of the Mexico City Electric Tramways Company, is expected to arrive in New York next week en route for England. While in New York, Mr. Stanhope, who will be accompanied by his secretary, Mr. James H. Bradford, will, it is expected, stay at the Hotel Albemarle. He does not anticipate returning to Mexico before January, 1903.

DR. W. J. MORTON, the well-known medical expert and electro-therapist reports in the "Medical Record" some extremely interesting results with regard to the successful treatment of cancer, appendicitis, etc., by means of the Roentgen ray. He has even treated the brain in one or two cases of melancholia. He says: "The question may be reasonably asked whether the general therapeutic effects of X-radiation are not due to a capacity for establishing favorable tissue metamorphosis rather than to a capacity for destroying or modifying bacteria or other micro-organisms."

OBITUARY.

MR. CHAS. W. PRICE, a well-known pioneer in several lines of electrical work, died at East Orange, N. J., June 10. Mr. Price entered the service of the Western Union Company at the age of 17 and at the outbreak of the civil war went to the Pacific coast to take charge of the lines of the Pioneer Telegraph Company. About the end of the war he went to Siberia with the George Kennan party which made surveys in the interest of the Western Union Company for a trans-Siberian telegraph line. For some years he was general superintendent of the B. & O. Telegraph Company, and shortly after the formation of the Daft Railway Company Mr. Price became its general manager, and later acted as the representative in Portland, Ore., of the Northwestern Thomson-Houston Company. Subsequently he was with the Westinghouse Company in its Philadelphia offices, and at the time of his death was general manager of the Montauk Fire-Detecting Wire Co. Of genial disposition and with courteous manners, Mr. Price made hosts of friends who will deeply regret his loss.

EDUCATIONAL.

THE BLISS ELECTRICAL SCHOOL.—The 1902-1903 catalogue of the Bliss Electrical School, Washington, D. C., gives an outline of the electrical course taught at this institution. The course is of only one year, but it is comprehensive, the studies being restricted to theoretical and practical electricity and mechanical drawing. It is stated that the graduates are fitted to secure and retain good positions in the electrical industries. The tenth year of this school will begin next September.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Instruction in the summer courses of this institute is given during June and July of this year, supplementing the work of the regular school year. The summer courses are open to persons not students in the Institute of Technology. The programme includes, mathematics, applied mechanics, mechanic arts, drawing, language, history, chemistry, physics; civil, mechanical and mining engineering, architecture and biology. The entrance examinations for the regular course will be held on June 26 and 27 and Sept. 23 and 24.

THE STEVENS INSTITUTE OF TECHNOLOGY.—At a meeting of the trustees of Stevens Institute, Hoboken, Alexander C. Humphreys was elected President to succeed the late Henry Morton. Mr. Humphreys was graduated from the institute in 1881, and is now a prominent gas engineer. He is also President of the Hibbard-Rodman-Ely Safe Company of New York and of the Buffalo (N. Y.) Gas Company. He was elected a trustee of the institute on Dec. 23, 1891, and was President of the Alumni Association in 1885-6. He was a close friend of President Morton, and is expected to carry out the policy of his predecessor in his management of the institute's affairs. A short time ago Mr. Humphreys gave the institute $10,000 for the purpose of founding a scholarship in memory of his son, who was drowned in the Nile two years ago while trying to save the life of a younger brother.

Trade Notes.

THE GENERAL INCANDESCENT ARC LIGHT COMPANY has opened a sales office at 510 New England Building, Cleveland, in charge of Mr. H. B. Coles.

FOUNDRY SUPPLIES.—Catalogue No. 102 of the Osborn Manufacturing Company, Cleveland, Ohio, gives, in nearly a hundred pages, illustrations and brief descriptions of a complete line of foundry supplies, brushes, brooms, etc.

THE NATIONAL ELECTRIC LAMP COMPANY, Cleveland, Ohio, has executed a mortgage for $100,000 on the plant of the Brush Electric Company, which it recently acquired. The proceeds will be utilized in enlarging the factory and installing new machinery.

FT. WAYNE ELECTRIC WORKS.—Among the recent trade literature of the Fort Wayne Electric Works, Fort Wayne, Ind., are a catalogue (84 pages) of parts of "Wood" arc dynamos and an "Instruction Book" (No. 3008) for installing Fort Wayne type A oil transformers. Both publications are illustrated.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has recently issued bulletins Nos. 3034 and 3035, devoted to alternating and direct-current exhaust fans (direct-connected) and a small alternating current motor for use with flexible shaft. Both types of machines are illustrated and their features described, together with other pertinent information.

A FEW SWITCHBOARDS.—The Walker Electric Company, 19th and Hamilton streets, Philadelphia, Pa., has just issued a pamphlet containing handsome colored half-tone illustrations of many switchboards recently built by it for various plants throughout the country. These boards in many instances show intricacies of design that can only be met by the best engineering skill.

ELEVATOR MOTORS.—Bulletin No. 132 of the Holtzer-Cabot Electric Company, Boston, Mass., is devoted to the subject of this company's elevator motors. The constructional features of these machines are concisely described, and four illustrations give views of elevator motor installations in operation in Eastern cities. Tables give the dimensions of the various sizes of these elevator motors.

THE BURT MFG. CO. of Akron, O., installed two of its large Cross oil filters in the large packing establishment of Nelson Morris & Co., Chicago, Ill. Its catalogue describing these well known filters contains a long list of leading concerns in this and foreign countries who are using from one to as many as one hundred of these filters. The Burt Co. reports an unusually brisk foreign trade in its goods this season.

ELECTRIC LIGHTS ON NEW TRAINS.—The "Twentieth Century" trains that go into service on the New York Central and Lake Shore Railroads on June 15, 1902, making the run of 980 miles between New York and Chicago in twenty hours, will be equipped with the "Axle Light" system of electric lights and fans of the Consolidated Railway Electric Lighting and Equipment Company, 100 Broadway, New York.

ELECTRICAL SUPPLIES.—The latest catalogue and price-list of electrical supplies handled by the Central Electric Company, Chicago, Ill., contains 176 pages. It includes very few illustrations, almost the entire space being taken up by the price-list. From this list a faint idea may be obtained of the extent of the stock carried by this company. This price-list constitutes addenda to the company's Twentieth Century Encyclopedia of Electrical Supplies.

KELLOGG APPARATUS.—The Kellogg Switchboard & Supply Company, Chicago, Ill., has issued a very attractive pamphlet giving some excellent half-tone views of exchanges equipped with its switchboards and apparatus. The illustrations are very artistically executed, being printed in a very dark brown color, which gives a very handsome effect. At the back of the pamphlet are given two halftones of a power board, front and rear views. The pamphlet is a very fine piece of work and reflects great credit on the enterprise of the Kellogg Company.

ELECTRIC CLOCKS AND TIME STAMPS.—The American Clock Company, 18 West 34th street, New York, describes and illustrates its electric clocks and electric time stamps in two separate pamphlets. The clocks are automatically wound by electricity, the current being supplied by two cells of dry battery. The time stamp is operated electrically, the time being governed by a clock which changes the time on the stamp once every minute. This device is valuable in every business.

PORTABLE CRANE AND HOISTS.—In a booklet just issued by the Franklin Portable Crane & Hoist Company, Franklin, Pa., is described the portable crane and hoist manufactured by this company. This apparatus is designed for use in shops, factories and all places where it is necessary to lift heavy pieces of machinery or to transfer them from place to place, and this with the least expenditure of time and labor, and with safety. One man, by the aid of this machine, can lift a large casting or any piece weighing up to three tons, and convey it to any part of the works and place it wherever it may be required. The hoist is illustrated, and a table gives its various dimensions.

THE AUTOMOBILE & CYCLE PARTS COMPANY, Cleveland, O., has issued three separate booklets devoted to the subjects of brass and bell-metal balls, tool steel and Bessemer balls and high-duty tool steel balls. This company pays particular attention to the production of uniform material used in the manufacture of these balls, and the hardening of the same is also given special care. The chief aim of the company is to get stock which at the outset of manufacture is certain to work well, and which when hardened and ground can be converted into what are perfect spheres. These balls are recommended for high duty and are claimed to be superior to anything now offered.

THE KEYSTONE FOUNDRY AND MACHINE COMPANY, Philadelphia, Pa., is about to add to its works a machine shop 100 ft. x 100 ft., and a foundry 130 ft. x 200 ft.; each of which can be lengthened to 400 ft. Also a cleaning house 40 ft. x 80 ft., connecting the two main buildings at one end. The buildings will be built entirely of structural steel and brick, and all power will be supplied from a central electric plant. Contracts have already been placed for all of the electric cranes, generators and motors, but not for the wiring and switchboard. Most of the shop equipment has been purchased excepting that required for the machine shop. The plant is expected to be in operation by Jan. 1, 1903.

REPRINT OF THOMAS INSTITUTE PAPER.—The paper on "Static Strains in High Tension Circuits and the Protection of Apparatus," recently read by Mr. Percy H. Thomas before the American Institute of Electrical Engineers, has been reprinted in full by the Westinghouse Company. The author treats the subject in a comprehensive manner and, because of the non-mathematical character of the work, it will doubtless prove of interest to superintendents and station managers, as well as to electrical engineers. The reprint is copiously illustrated with diagrams and with views of the Westinghouse static interrupter. A copy can be obtained by writing to the nearest district office of the Westinghouse Electric & Mfg. Co.

FIRE DETECTING WIRE.—The Montauk Fire Detecting Wire Company, 100 Broadway, New York, has issued a list of some installations of its fire-detecting wire. The list includes many residences of wealthy New Yorkers, public buildings, stores and mills, one of the latter being in Melbourne, Australia. The utility of this wire was practically demonstrated recently in New York. A laundry stove in the residence of Mr. S. K. Lichtenstein became dangerously overheated and would have been unnoticed had not a fire-detecting wire running nearby given the alarm. The company has recently issued a pamphlet describing its new combination of high and low fusing wire. This wire is approved by the New York Board of Fire Underwriters.

"THE RIGHT OF WAY."—This is the title of a uniquely designed folder issued by the Banner Electric Company, Youngstown, Ohio. It refers to the bases for the claims made by the various lamp manufacturers for their product, with the intent of securing "The Right of Way." The foundation of the claim for "The Right of Way" by the Banner Company is the superior quality of its goods. The company has a new factory building arranged especially for its needs, which is equipped with the most modern machinery and instruments for producing the highest grade of lamps. The company lays particular stress upon its claim as to the quality and life of the filaments made by it. The Banner Company manufactures incandescent lamps of all standard voltages and designs.

Record of Electrical Patents

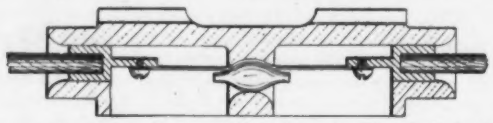
UNITED STATES PATENTS ISSUED JUNE 3, 1902.

(Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., New York.)

700,809. MEANS FOR EXTINGUISHING ARCS IN ELECTRICAL APPARATUS; G. W. Partridge, London, England. App. filed March 29, 1901. A capsule of compressed air or explosive material is discharged at the instant any fuse is blown, to disrupt any arc that may form. (Issued May 27.)

700,911. SIGNAL FOR COMPOSITE TELEGRAPHIC AND TELEPHONIC TRANSMISSION; E. L. Grauel, Carthage, N. Y. App. filed Jan. 24, 1902. Consists in imposing on a current of fixed direction, an undirectional pulsating current, thereby unbalancing the current of fixed direction in one half and reinforcing it in the other half of the circuit. (Issued May 27.)

701,280. ELECTRIC METER; H. Aron, Charlottenburg, Germany. App. filed Feb. 20, 1902. Consists in employing a planet-wheel gearing which determines the length of time of delivery of the current and a second planet-



700,809.—Means for Extinguishing Arcs in Electrical Apparatus.

wheel gearing, which drives the clock mechanism and also operates the cut-out device to interrupt the circuit when the period of time for which the first-named planet-wheel gearing mechanism was set during which current will be delivered has elapsed.

701,290. MAGNETIC CLUTCH; H. W. Buck, Schenectady, N. Y. App. filed Mar. 20, 1899. The clutch contains a normally excited demagnetizing coil which acts to release the clutch and prevent sticking when the energizing coil is cut out.

701,295. INCANDESCENT ELECTRIC LAMP; A. A. Chaillet, Shelby, O. App. filed, Oct. 22, 1900. The filament is coiled into several convolutions in the dome of the lamp; the axes of the convolutions being so directed as to cause the lamp to throw the greatest amount of light downward.

701,319. PRIMARY BATTERY; Eugene M. Fishell and William R. Clymer, Cleveland, Ohio. App. filed Oct. 14, 1901. A copper oxide caustic soda battery so constructed that it may be shipped in condition to be used. The containing case is of cylindrical form and made of tinned iron, thus serving both as a containing vessel and as a negative electrode. Within the vessel a concentric perforated tin partition is soldered to the bottom and extends to within a short distance of the top. In the annular space thus formed is placed first a layer of sand, next a layer of fine subdivided black oxide of copper, and finally a layer of pitch. Within the central cavity is suspended a zinc submerged in caustic soda. The case is hermetically sealed at the top.

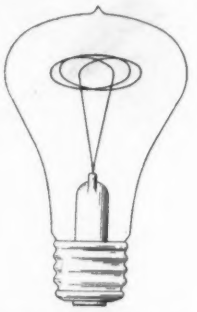
701,338. ELECTRIC METER; C. D. Haskins, Schenectady, N. Y. App. filed Oct. 26, 1901. In the field circuit of the motor there is included a conductor having a negative temperature coefficient, for the purpose of causing the drop of potential in the field circuit to be less than proportional to the current flowing therein.

701,341. ELECTRIC MOTOR; A. B. Holson, Chicago, Ill. App. filed July 15, 1901. Certain details of construction enabling the motor to be combined with a wheel hub.

701,363. PROCESS OF MAKING ELECTRIC BRUSHES; Robert D. Laughlin, Ravenna, Ohio. App. filed Dec. 30, 1901. Wire is wound spirally and longitudinally upon plates of green carbon; one or more of the plates thus wound are placed between other green carbon plates without winding; the composite plate is then so compressed as to unite the carbon of the several plates into a homogeneous mass, which is finally baked.

701,369. CARBON BRUSH AND PROCESS OF MAKING SAME; William Mills, Jersey City, N. J. App. filed Nov. 5, 1901. A carbon brush composed of a layer of high conductive material and a layer of relatively low conductive material, which latter consists of a mixture of carbon and a

700,911.—Signal for Composite Telegraphic and Telephonic Transmission.



701,295—Incandescent Electric Lamp.

substance similar to ground stone, mica, coal, etc., cemented together with a suitable plastic binder.

701,374. ILLUSTRATING APPARATUS; F. S. Newman, Springfield, Mass. App. filed Jan. 17, 1899. (See Current News and Notes.)

701,389. STORAGE BATTERY ELECTRODE; Johannes Von Der Poppenburg, Charlottenburg, Germany. App. filed April 30, 1900, renewed April 17, 1902. The conducting frame is provided with removable non-conducting cross pieces having performed portions projecting on each side, in connection with perforated protecting strips, the active material being interposed between the said strips; removable vertical elastic bars are held in the perforations of the cross pieces and adapted to press the protecting strips against the active material.

701,396. ELECTRICAL PROTECTOR; C. A. Rolfe, Chicago, Ill. App. filed Aug. 1, 1900. Details of a fusible protector.

701,423. ELECTRIC ARC LAMP; Geo. G. Tilden, Newark, N. J. App. filed Aug. 10, 1901. The device by means of which the feeding of the upper carbon is accomplished, consists of a toothed wheel against which the carbon is pressed by a suitable spring. The force of the spring pressing the carbon against the toothed wheel is sufficient to hold the former in place, except where the wheel is partially rotated through the action of gravity or a spring, or a shunt magnet.

701,455. CONTROLLER; T. Von Zweigbergk, Preston, Eng. App. filed Jan. 23, 1902. These improvements relate to the moisture protectors, the contact segment and fingers, the solenoid blow-out and the cover-clamp.

701,456. CONTROLLER; T. Von Zweigbergk, Preston, England. App. filed Jan. 23, 1902. Associated with the reversing switch is a peculiar lock which, when the switch is used to apply the emergency brake, prevents the switch being changed from this position by the ordinary operation of the lever.

701,472. APPARATUS FOR COVERING FLEXIBLE CONDUITS WITH RUBBER IN CEMENT OR LIQUID FORM; J. T. Dickey, Hoboken, N. J. App. filed June 7, 1901. Details.

701,488. GAME COUNTER; W. J. Lewers, Wilkesbarre, Pa. App. filed Oct. 15, 1901. A combined game counter and annunciator by which an alarm is sounded when the winning score is registered.

701,572. ELECTRIC BELL; H. F. Keil, New York, N. Y. App. filed Aug. 2, 1901. The armature is mounted for adjustment in two directions.

701,577. LIGHTNING CONDUCTOR; Franz E. Klein, Dresden, Germany. App. filed March 31, 1900. A horn-shaped lightning arrester in which there are provided near where the arc is to be formed, paramagnetic bodies, consisting of sheaths which partly surround the horns, but leave free their inner edges, which face each other.

701,608. ELECTRIC CONTROLLER; A. Phillips, St. Louis, Mo. App. filed Sept. 23, 1901. Details.

701,609. ELECTRIC SWEATING ROBE; A. Phillips, St. Louis, Mo. App. filed Sept. 23, 1901. An electric heating wire is arranged through the folds of a robe or garment for the purpose of giving a heat bath or sweat to a patient.

701,621. CIRCUIT BREAKER; B. P. Rucker, Brooklyn, N. Y. App. filed Nov. 26, 1901. Means for releasing a movable member instantaneously under a predetermined excess of current, and for releasing said member after the duration of another predetermined excess of current.

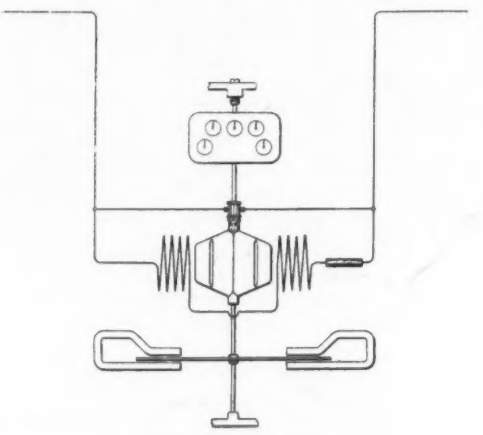
701,627. SWITCH FOR ELECTROMOTORS FOR DRIVING DENTAL APPARATUS; E. Schrier and H. Dumler, Vienna, Austria-Hungary. App. filed Jan. 10, 1902. A switch for stopping, starting and reversing the motor is controlled by a switch on the handle of the tool which is driven by the motor.

701,647. ELECTRICAL APPARATUS; A. Tzaut, Neufchatel, Switzerland. App. filed Feb. 18, 1902. Details of a circuit testing apparatus.

701,650. MANUFACTURE OF CALCIUM CARBID; D. De Vulitch and J. D'Orlowsky, Paris, France. App. filed Dec. 13, 1900. (See page 1057.)

701,680. SOCKET FOR INCANDESCENT LAMPS.; C. A. Chase, Chicago, Ill. App. filed Jan. 16, 1902. A receptacle designed to embody a small and light porcelain frame on which the terminals are separated as widely as possible.

701,685. ELECTROPNEUMATIC SWITCH SYSTEM FOR ELECTRIC RAILWAYS; W. H. Cummer, Toledo, Ohio. App. filed Nov. 3, 1901. The motorman by operating the controller, can control certain electric



701,338.—Electric Meter.

curcuits to move the valves of a pneumatic switch-throwing mechanism. After the car has passed the switch, the switch-operating mechanism, is automatically restored to a neutral condition.

701,713. MANUFACTURE OF ELECTRICALLY INSULATING AND WATERPROOFING MATERIALS; Frederick Greening, Plumstead Common, Eng. App. filed Dec. 6, 1900. The process consists in mixing with fused anthracene a proportion of copal resin.

701,725. ELECTRIC SWITCH; G. Higginson, Westminster, London, Eng. App. filed Jan. 28, 1902. Details.

701,804. REVERSIBLE GALVANIC BATTERY; T. A. Edison, Llewellyn Park, N. J. App. filed June 20, 1901. (See Current News and Notes.)